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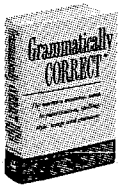

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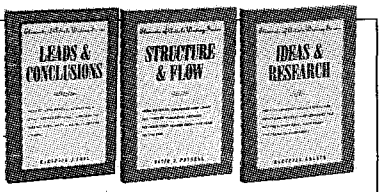

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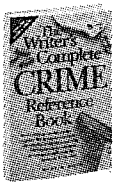

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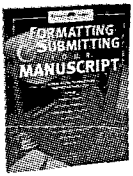

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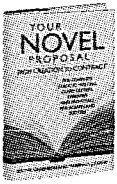

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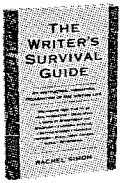

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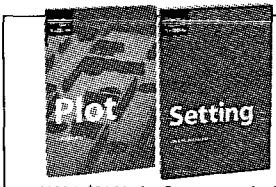

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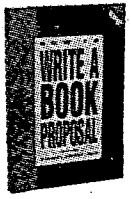

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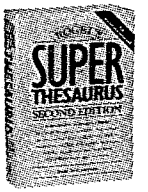

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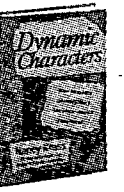

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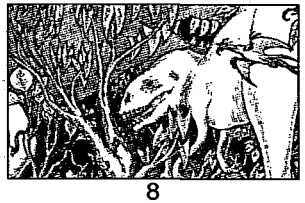

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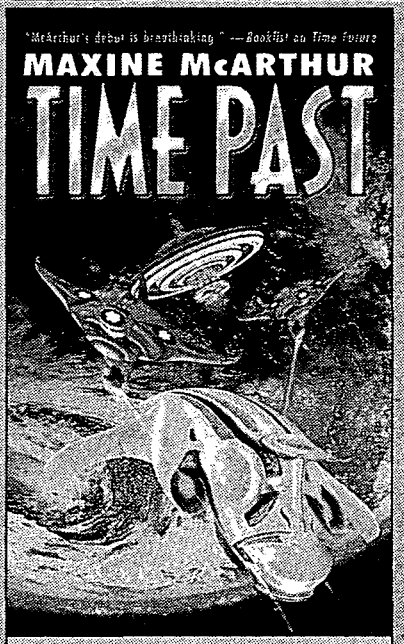

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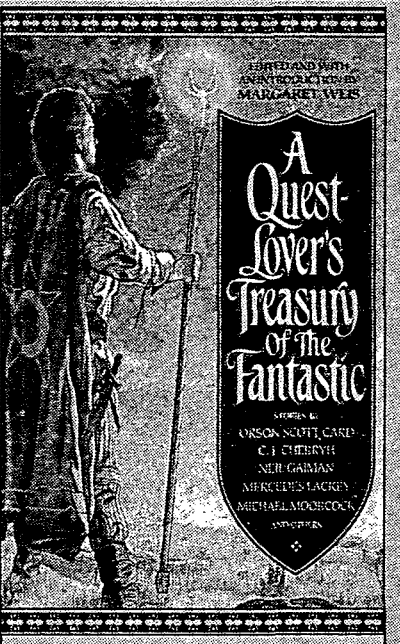

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EDITORIAL Stanley Schmidt

PERSPECTIVE

After the infamous terrorist attacks on the World Trade Center and the Pentagon on September 11, 2001, we quickly began to hear many people talking about how the world had forever changed and they could never feel safe again. But how much has the world really changed, and how often could people really feel safe before?

It's hard to have a sense of perspective when you're this close to an event that traumatic, but it's probably worth some effort to regain one. The fact is that the "scary new world" into which we have been plunged is in many respects (though obviously not all) more "normal," in historical terms, than the one we've become accustomed to over the last decade or so. Shortly after the Soviet Union fell apart at the end of the '80s, somebody published a book called something like *The End of History*, suggesting that there wasn't much left to happen in the way of major conflicts and such. At that time I was struck (and amused) by the irony of anyone actually believing that, but many of us have gotten into the habit of living as if it were true.

It wasn't, of course, and we have just been dramatically reminded of it.

Since the collapse of the Soviet bloc and the consequent evaporation of the Cold War, most of us haven't thought much about the threat of annihilation by nuclear weapons wielded by political enemies. On the rare recent occasions when the United States has waged war, it has been in safely remote locations and conducted with high-tech methods that could be used with relatively little danger to those using them. Since any number of advances in medicine, we have come to take life expectancies in the seventies for granted.

But these are very new, historically "abnormal" conditions. There have been few times and places when people *could* feel safe, and even then the security was often illusory. I remember vividly that my elementary schools routinely held "air raid drills" because Soviet nuclear bombs were considered a real possibility that could materialize at any time. People lived with the threat of such attacks hanging over them for *decades*, ever since Hiroshima. They didn't feel absolutely safe, but they got on with their lives. Young men during the long, drawn-out Vietnam war lived with the threat of being drafted into combat for reasons that didn't make much sense to them, and everyone lived with the remoter threat of the conflict spreading from "over there" to "over here." In the wake of the terrorist attacks of 9/11, the U.S. launched a "war on terrorism" which an overwhelming majority supported—except that some of them began to get cold feet when they realized it probably couldn't be done without casualties, including civilians, on both sides. Only someone without much memory of past wars could seriously entertain expectations of zero casualties; wars have *always* involved casualties, including unintended ones. (Which is one reason why war should be treated as an extreme last resort, to be used only when all other alternatives have been exhausted.)

The "new" threat of terrorist attacks, which we can expect to have hanging over us for quite a while to come, feels more like most of the decades of my life than like the last one. No, we can't feel

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perfectly safe, but then we never could, really. We've always had to live with hanging threats of various degrees of remoteness, from crime and war and earthquakes and hurricanes to asteroid impacts. And, of course, disease. We talk a lot these days about the horrors of pollution, and the terrible numbers of deaths from cancer and heart disease—conditions that, not so long ago, few people lived long enough to develop because other things got them first. According to *The World Almanac*, the life expectancy for Americans in 1900 was about 47; in 1998 it was 77—an increase of about 60 percent. And while we may be more aware of the dangers of pollution now than we used to be, in many respects we actually have a lot less of it. I remember, for instance, what the air in cities was like when they burned lots of soft coal.

As G. Harry Stine wrote in his "Alternate View" column on "Memory and Perspective" in March 1984 (which most of us would do well to reread about now), "The good old days were the good old days only for a privileged few. For the average person—the farmer, the industrial worker, the housewife—life was a short, brutal period of unremitting hardship because of air pollution, lack of sanitation, poor food, poisoned drink, drugs, long hours of work at low pay, little or no education, rampant crime, hazardous travel, brutal quackery posing as medicine, and violent and senseless forms of leisure if you had some spare time."

We haven't gone back to that, but we have returned to a state of vague, chronic unease similar to that prevailing for much of the twentieth century. When some of us say "we can no longer feel safe," it is not so much a matter of a new state of mind as a return to an old, too familiar one.

In at least one important way, though, the world really *has* changed. The September 11 attacks were a dramatic demonstration of what can happen when too much technological power is concentrated in too few hands that cannot be trusted with it. A few years ago (October 1998), my editorial "The Fermi Plague" offered a disturbingly plausible solution to the Fermi paradox, the observation that what we know about astronomy, biology, and physics suggests that technologically-advanced civilizations should be fairly common, yet we've seen no direct evidence of them. I suggested a single thing that could have a high probability of eventually destroying any sufficiently advanced civilization: the greatly increased amount of havoc that technology can enable individuals or small groups to commit, and the high probability that a growing population will eventually produce at least one nut willing and able to do so.

"The Fermi Plague" was directly suggested by an anthrax threat (which turned out to be a false alarm), but the issue here is not anthrax, or biology, or any particular technology. The real danger is individuals or small groups having far too much power at their disposal, and the events of 9/11 were a horrifying demonstration of principle. Some might argue that this danger became acute with the

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first nuclear bomb; in World War II; but while that did enable the crew of a single airplane to demolish a city, they couldn't have done it without a massive commitment of resources by a powerful nation to develop the tools. What has changed recently is that it no longer takes a nation to do such damage. The tools already exist, and are too readily available.

True, the World Trade Center was not the world; but it was quite enough to demonstrate how much damage to lives and property a small band of nuts can do with even today's technology. And since change goes on, what we have seen, terrible as it is, is by no means the worst that can happen. If anyone ever thought that the speculation in "The Fermi Plague" was a mere academic exercise, it should now be abundantly clear that it is anything but. It is a clear and present danger, and quite possibly the most serious we have ever faced.

We *must* find ways to ensure that such people can no longer act—and we must achieve that without falling into the traps of indiscriminate slaughter or attributing guilt by ethnic association. The nature of the problem is so novel that we can be sure that real solutions will be at least equally novel. We cannot expect to find them by continuing to apply old methods "only more so." We need thinking that tries radically different approaches from any we have seen before, whether they involve technological inventions, social inventions, or some combination of both. The need is both urgent and long-term. If we fail to find such solutions, we—not just as a nation, but as a species—are in trouble so deep that the word "trouble" is totally inadequate.

But I wouldn't bring it up if I thought the situation was hopeless. The problem is enormous and difficult, but we have faced and solved enormous and difficult problems before. And this one, it would seem, lends itself especially well to the kind of "experiment" that's best done—at least initially—in the science-fictional "laboratory."

In the meantime, one other issue has been given new urgency. If we care about preserving the human race, we must get some of it off-planet. In the fairly recent past, arguments for this have often focused on the fact that asteroid collisions with Earth have produced massive extinctions before and inevitably will again, though we don't know when. That remains true, and a valid reason for creating an insurance policy by spreading out. But what now looks like an even bigger threat, and more likely to become urgent soon, is the destruction of humans by humans—not "us" doing unto ourselves, but all too few of us doing unto all the rest. ■

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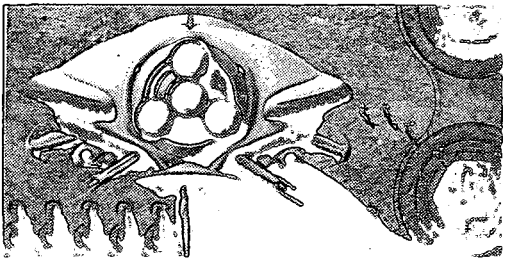

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SIDEHUNTER

Rajnar Vajra

Illustration by Wolf Read

Parson's Planet was a nasty place, by human standards—and not all the nastiness was homegrown.

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My heart was racing and a private pool of sweat was collecting in the small of my back. After two tense months in superspace I was finally down on Parson's Planet, inside Parson Station. But I still wasn't feeling overly safe. Five minutes ago I'd had the nastiest scare of my scare-filled career. And right now, something was very wrong.

George Friskel, the station's "commo" (communications chief), had promised to be waiting right here to welcome me. He'd lied.

This solitude wasn't soothing, especially since my nearest allies, on the ISS *Centipede*, were thousands of vertical kilometers away.

Ten minutes later—still no Friskel. I'd outlined my mission to him via ultrawave audio but hadn't described myself because I hadn't wanted to spoil the surprise.

So far, the surprise was on me.

Fortunately, I'd killed time during the interstellar flight by memorizing a station diagram. *Ave* boredom! Perhaps I could find Friskel's office unaided . . .

I was facing south. The hydroponics garden should be in the closed-off dome behind me, administration more or less straight ahead.

I hurried forward, trying to cheer myself by imagining Friskel's reaction when he saw me.

Happiness proved elusive. The hallway century-lamps were barely glowing. They were hoarding electricity here and were even stingier with sounds; all I heard was a soft droning, occasional metallic clanks, and echoes of my own breathing. The air smelled weird. I began getting this bad feeling that Parson Station had been abandoned, I was about to find out why, and I wasn't going to enjoy the experience.

"Susie," I told myself, "what you *don't* need in your job is imagination."

Then I noticed the whine of a medical scanner, inaudible to human ears. If Friskel was receiving the data, my prank was spoiled. But at least an operating scanner implied company!

Encouraged, I continued through gloomy and increasingly smelly corridors.

Upon reaching what I hoped was Friskel's door, I was absurdly relieved to hear someone moving inside. I knocked gently.

"Professor Artab?" a muffled voice inquired. "Is that ye already?"

"Ce'tainly is," I admitted. For reasons that I will reveal in my own sweet time, I couldn't pronounce the letter "r" at this point and my "l"s were mushy.

"Come in then, 'tisn't bolted."

The door was a powered affair, operated remotely or controlled locally by a wide, dirty pressure-sensing plate. I pressed the plate, vaguely puzzled by my own hand. *Seven* fingers?

I wiped my palm against my faux slacks while the entrance widened. Then I stepped through swiftly, ducking to clear the lintel.

Friskel had a stack of folders in one arm; the other extended for a handshake. When he saw me, folders went flying . . .

Somehow, his reaction wasn't so amusing. And the way he kept pointing his index finger at my chest was downright creepy.

He looked about thirty. Deep-set blue eyes crowded a cucumber nose, his depilated arms and head were tattooed with scars, and one eyebrow was AWOL. He was pungent with the station aroma; close-up, it suggested burnt lemon rind.

As the papers settled down, so did Friskel. "*You* be Professor Artab?" he croaked, finally lowering his finger.

I bowed acknowledgement.

A vase on his desk, near an antique microtelephone, held a crimson flower atop a shiny green stalk. The air was still, yet the flower kept waving around.

"Jeez! Ye might have said *somethin'*." Friskel's voice was steadier than his thick hands. "Christ, ye near give me a

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hard attack!" I'd talked to this man weekly, and his localized English still seemed charmingly quaint.

To an innocent, a thumbscrew might seem quaint. . . .

"Sowwy," I muttered, bending to help harvest folders. "Hadn't I mentioned I was a hybwidim?" I felt too embarrassed to admit my little joke had been intentional. Yelling "boo" would have been more sophisticated.

Another humiliation: inability to pronounce "hybridim."

"Mentioned it?" the Commo rejoined. "Rambshit! Yet . . . considering, who'd be better for this duty than a prince of the Assembled?"

"I may have been assembled, but I'm no pwince."

Friskel was criminally unobservant! Then it dawned on me, painfully, that my latest physical "improvements" had finally made my gender unrecognizable. Withheld tears burn the worst . . .

"Wheah is evewybody, Geowge? This place feels like a ghost station."

"Here and aboot. Uh . . . deep apologies I wasn't awaiting ye. Lost track o' time—getting old I fear." Momentarily, he looked troubled.

"That's all wight."

"Shall we set to business?"

"Suits me."

"Business" was paperwork. With actual paper! Friskel claimed "true" signatures were required.

As I filled out release forms, he asked, delicately, what I'd been assembled from. I mentioned lion, fox, bear, shark . . . leaving out far more interesting donors.

"Jeez! I've been here so long, I near forgot about some of those Earth crits." He peered at me curiously.

"Your feet are—what was the dangly word? Ursine?"

"That's it."

"But ye started as human?"

The question seemed absurdly offensive. "What else? And I'm *still* mostly human—despite my good looks."

"Ah. Me, I like animals, with some exceptions, but I wouldn't care to become one. Especially in bits and pieces. Why would ye do such a thing to yourself?"

I was tempted to tell him.

Twelve years ago I'd been a xenobotanist, a normal woman, teaching at a good university, with a good life on an Earth-like planet named Rush. I'd had a husband and daughter I loved.

But the Philyra Corporation, "Purveyor of Fine Perfumes," learned that a certain flower, the Blue Ireil native to equatorial Rush, produced a fragrance to . . . die for. Philyra skimped on ecological research, getting instant permission for a huge harvest through bribes and faked certificates. So many fields of Ireil were removed, our local fire-bees (supposedly harmless) swarmed into our cities, desperate for any kind of sugar.

I survived. The day I was discharged from the hospital, I hobbled to the nearest Ecomission office and told the freshly arrived officers to sign me up. I needed to fight the kind of blind selfishness that had killed so many people, including my husband and daughter.

Maybe I wouldn't have been so eager to volunteer, but I'd been the fool who'd told Philyra about the Ireil. . . .

Friskel was waiting. Why had I been willing to sacrifice my humanity and quite possibly my life someday? Even if I trusted this man, my wounds were still too fresh to uncover.

"It seemed wothwhile," I replied.

"Really?" He studied my two and a half-meter form with a peculiar intensity.

I turned to sign the final form. "Done. Now, wheah am I most likely to find a sidehunteh?"

Sidehunters, I should explain, are predators, strange even by galactic standards. Supposedly, they stood on the crumbling brink of extinction. My assignment was capturing some, then hauling them to the Xenozoo's Species

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Preservation Facility on Mars. The SPF had somehow already obtained clonable tissue samples from another zoological oddity: the sidehunters' prey.

"*Likely?* Greg Parson will take ye to Albamy Jungle where the last sighting occurred. Parson be stationmaster and our Founder's great-grandson. Uh . . . ye may believe our world be rated seven on Kirby's Risk Scale."

"Seven point two."

"Well, now . . . that be singing a bit softly."

"You mean seven's too *low?*"

"On a good day, Professor, Parson's could overtop ten."

Ten? Then why wasn't Parson's on the Proscribed Planets list along with horror worlds like Conibel or Swatt? An extra trickle of sweat rolled down my back. An old station report had described the jungle as dangerous, but—hell, I'd once briefly visited Swatt, rated 8.8, and survived by the skin of my shark teeth.

Parson's Planet couldn't be worse!

Ecomission scientists couldn't say how many sidehunters were left. Albamy is thickly canopied; orbiting telescopes are impractical for observing the jungle floor. Likewise, chromathermic scanning and chromaphotography are usually a waste of time or film because sidehunters' bodies regulate themselves close to ambient temperature.

Twenty-two parsecs away, xenobiologists on Mars had readied a cloning and forced-growth lab; with luck, skill, and enough genetic material, the sidehunter species might be preserved. Assuming someone could capture such dangerous and elusive beasts.

So far, nobody ever had.

As Friskel and I pored over a stereo map of Hame Continent, his scent—burnt-lemon, adrenaline, and sweat—intensified. What was he so afraid of?

With a scarred finger, he traced a line running due east from station to jungle. The map was scaled in miles, but I figured the distance as 130 kilometers.

Then he dropped a bombshell. He said it might take four days to get me there!

I'd assumed that somebody would fly me out on a station shuttle. Friskel regretted this "misunderstanding" but claimed that the station's only shuttle was undergoing extensive repairs.

"A pity, too," he observed. "Ground travel here be a wretched affair."

"Why?"

I saw a glint in his eye: possibly amusement, perhaps pity. "Ye'll find out. If I spoke, ye wouldn't believe.

"Keep the map," he ordered, "but . . . *don't* advertise it. Station property and all. Turn right at the corridor's end. Keep going until ye come to a four-way intersection; have another right. Then seek a double-door marked 'AATV.'"

"AATV?"

"'Armored All-Terrain Vehicle.' Enter and Doctor Parson will be waiting. Ye spot all that?"

"I think so. Thanks. I'll see you when I get back. Pawson has my cages?"

"Aye. Well . . . best luck!"

I suddenly saw my astonishing idiocy. With the station's T-comm, I could contact Captain Becker and simply have *Centipede*'s shuttle pick me up and ferry me to Albamy. But the idea bounced from my awareness like a water droplet hitting a hot griddle.

The mind is its own trap, to paraphrase Milton.

I'd heard about Greg Parson, CEO of Parson Pharmaceuticals. He was only thirty-five, but already a legend in submolecular biology. Supposedly, he was often off-planet, lecturing and consulting; whopping fees were rumored.

Yet, it wasn't startling that the stationmaster himself was offering me a lift.

On Earth, 130 years ago, humanity had gotten a lesson. Oceanic pollution had dangerously diminished Earth's primary source of fresh oxygen: pelagic phytoplankton. The consequences had

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caused the Interworld Council to see ecological matters in a brighter light. They'd awarded the Ecomission impressive powers.

Since then, Ecomission personnel (even Hybridim) have been treated with respect.

From the hallway, I waved to Friskel and sauntered away. His door clicked shut. I hustled to hide behind a nearby corner, tucked the map away, and listened.

The commo's door opened and closed; I'd figured he might check to see if I was really gone. I waited another moment, then shifted my hips forward, locking my spine into running mode. I dropped to all fours and silently bounded back. Outside the office, I was all ears.

"Right," Friskel was saying. From the faint buzzing reply, I knew he was using that old-fashioned phone I'd noticed earlier. "A cob-job, Boss. And *big!* Why the hell didn't ye say when ye saw the scan? Bigger'n ye with your ma's high heels and your da's high helmet! A splicer—Christ, I speaked to him for months and never guessed."

Buzz. Buzz.

"No. But wait 'till ye hear him talk! If he weren't so scary, ye'd bust a gut! Anyway, I'm telling ye: He's deep dangerous for sure."

I grinned sadly, about to turn away, when Friskel continued. "Another thing. I'll warrant our splicer trips *horizontal.* He looked . . . wrong standing upright and his arms be fearful long! Bet he's a real mover. What? Hell, no! He looks tough, but I'll lay wide odds he won't last more than ten minutes alone in deep jungle. Okay. Take care and we'll see ye at week's end."

Damn! I'd been warned the stationers might be sharper than they looked. I dashed down the corridor, making up time. Near the four-way intersection I stopped and stood, my lumbar curve resettling with a soft click. I strolled into the intersection.

The air coming from the left carried the strongest stench yet. A guard was blocking an extra-wide doorway five meters down that passageway. He was holding a blue-laser rifle and pretending he didn't see me. I followed instructions, taking the hallway to the right.

"Professor Artab, I presume?"

"Yes."

If my appearance alarmed Dr. Greg Parson, he didn't show it. He was taller than Friskel and even more battered. Two fingers on his right hand were stubs; one ear had been partly chewed off. In the corded muscles of his neck was a scarred sinkhole of missing flesh.

Didn't regeneration techniques work here? Evidence was mixed. Parson had missing fingers but shiny new teeth . . . or implants.

He stood jauntily, as if he were sporting a top hat and twirling a silver-crowned cane. Instead, he wore a color-shifting chameleon suit and a hefty collection of weapons holstered in a chameleon waist-belt. I counted four slammers and an automatic pistol.

Excessive? He *also* carried a laser rifle, one behemoth-sized fuel-cell, five grenades hanging from their own belt, and two long knives poorly hidden under the zippers of his trouser legs, which were secured to color-shifting boots.

I was beginning to suspect the local wildlife wasn't friendly.

Parson didn't offer his hand, but favored me with a microscopic bow. "An honor, sir," he said stiffly.

"The honeh is mine. But please call me Awtab." Evidently, he hadn't caught my feminine side on the scan and I was in no mood to enlighten him. "When do we leave?"

Aside from their coldness, the stationmaster had beautiful eyes, teal irises ringed in yellow. His scalp and chin were depilated like Friskel's (and mine) as a precaution against Hame fungus.

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But his delicate lashes and high-arching brows contributed to an overripe air of refinement.

Eyelashes and eyebrows, always infested with specialized mites, are immune to the fungus. Turns out such mites relish ciliafungi. You never know what's going to come in handy. . . .

"We'll leave when I'm convinced ye ken the facts o' life," Parson stated. He spoke softly, but what an abrasive voice! Evidently, his vocal folds were beaded with glass shards.

"Which facts?"

"Have ye heard o' planet Conibel, Professor?"

It took a moment to identify an unfamiliar sensation in my chest: anger. Normally, my feelings of loss and guilt override petty annoyances. Yet I was starting to hate this man. He wore a presumption of superiority like a loud Hawaiian shirt. Also, I didn't appreciate the topic; I had secrets concerning Conibel.

"I know of it," I confessed.

"Conibel be famous for outlandish creatures. Yet—do ye ken the word 'voracious'?" I nodded, conceding it was within my limited vocabulary. "Crits here be *more* voracious."

"Fwiskel implied as much. But my ship's datasehveh only mentioned—"

"We don't want this known."

"Why not?"

"Thrill-seekers would home in, like those fools sneaking into Conibel's Forbidden Forest. We can't be bothered by lawsuits from relatives of the eaten."

"Eaten? Alien animals kill humans, admittedly, but why would they find humans . . . appetizing? Owe digestible?"

He feigned a pitying look. "Our crits and brits haven't survived through picky eating." A "crit," I'd been told, was an animal and a "brit" was anything alive that wasn't an animal.

"Seems unnatuwal."

"Nature, sir, *defines* natural. Remember: This world has gone through massive changes. Life had to become flexible."

True. Some dozen million years ago, the local sun, Gienah, had been a small white star. . . .

Parson eyed me thoughtfully. "Tell me somewhat. See my costume? This be a 'hidersuit.' Try to nose me. Whiff anything?"

His scalp was dirty, his breath heavy as a man twice his age, and he reeked of burnt-lemon, but I couldn't smell anything emanating from beneath his suit.

"No," I replied with more tact than accuracy.

"Course not. Now I'll tell ye somewhat: Your Ecomission bosses be determined to get ye killed."

"How so?"

"We've been instructed not to train ye or lend ye hidersuit or footswear—not that we've any your size—and not to *bother* ye in the Jungle."

"I'll take my chances."

"Chances? With no weapons? No hidersuit, goggles, or UV protection? No boots? We normally require a year of instruction 'fore a newcomer be allowed to step outside, and another year 'fore they cross the fence. Professor, ye be dead . . . unless ye carry Jopper's luck in abundant measure!"

I'd only heard "Jopper" as part of "Jopper's ramb": a ramb being a kind of herd animal you wouldn't try to, say, milk. But if Parson kept patronizing me, he'd be needing some surplus luck himself.

The stationmaster donned a flexible, chameleon helmet; even its visor changed colors. He pulled on gloves covered with tiny flat disks and strode over to a wall-mounted control panel.

"Here be the airlock; we must flash it proper." He turned toward me momentarily, probably confirming that I was too distant to see the panel's keyboard. Predictably, he'd underestimated my eyes. He typed ten digits and I made sure to memorize them.

Suddenly, the closed airlock was blazing with infrared. A human couldn't have seen the heat as I could, but they would have felt it! Such doorways are in-

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variably well insulated—how hot had it gotten *inside* the huge lock?

"That should give lurkers somewhat to think aboot! I'm opening t'inner door. Stay alert!"

Cooling units were laboring, but the escaping air was like foundry heat on a summer day. As we stepped inside, I had to shift from foot to foot to avoid burns, and my latest feet are *tough*. Where did these stationers keep their damn vehicles? Outside?

"Now, we flash the outer lock, and ye will get your first sight o' the compound. Don't touch the building or fence and for *sure* don't test the acid moat with a toe. And never stand still. Without footswear, ye be prime bait for spike-worms and hemotodes."

Soon, impossibly vivid daylight was jabbing my startled pupils while alien sounds baffled my ears. The cloudless sky was blinding indigo; vegetation surrounding the compound appeared to be sheathed with verdigris. We stepped onto a section of ice-smooth flooring—fused crude glass—still hot from the "flashing." The lock snapped closed. I turned to regard the stranded-jellyfish bulk of the station from the outside.

My augmented eyes adjusted. Something large atop the flattened, distant summit of the highest dome reminded me . . .

My long shuttle descent from *Centipede* to the station had ended with a shocker. On final approach, Bill Ku (my pilot) had gasped, pointing toward the vessel's virtualport. I'd ignored safety regs, leaning over to peek. At that moment, we were fifty meters above the station's roof-based landing circle. Yet right next to us, just beginning to fall, was a large and terrifyingly ugly animal. A deformed giant green octopus with two extra tentacles. A decapus, I suppose. We'd practically collided with it.

How had it gotten up so high without wings? Besides, the thing was obviously too heavy to fly. Billy must have feared it was raining monsters; he set the virtualport on both fish-eye and rapid sweep, not recommended for landings.

Seconds later, touchdown was rough enough to dent Billy's pride, if little else. I allowed that his clumsiness was understandable and showed him *my* quivering hands. We hurriedly unloaded the cages through the shuttle's floor bay, and the instant I'd entered Parson Station, Billy took off in an atmosphere-tearing hurry.

I'd been delighted to go directly from the shuttle's interior to the station's interior. If only my mission allowed me to *stay* inside. . . .

A brown decapus was squatting on a dome, trying to eat the greasy white roof.

"Can those things . . . jump?" I asked quietly.

Barely glancing up, Parson explained, "Bloody bastards stretch themselves out on trees and shoot themselves off like rubber-bands."

Lord! No wonder the airlock was ringed with gleaming plasma-coil nozzles! These stationers didn't take chances . . .

What stationers? So far, I'd only seen three, when Ecomission records claimed four hundred residents.

"Why—"

"Damn ye! I told ye to keep movin' and keep your fool eyes *open!*"

I whirled around. The noisy air was hot, heavy, smelling of chocolate and rot. The alien sun was a blinding Halloween pumpkin. Everything was eerie with reflections from cloyingly verdant foliage. Twenty meters ahead was an electrified perimeter fence topped with needle-sharp spikes and blue-white gas jets. Past the fence, a wide moat glittered green. Beyond that—I wasn't ready to take it in . . .

Parson gestured for me to proceed.

I took one pace onto loose sand. A blurred form came bounding toward me, I jumped sideways. SNAP! Something sharp grazed my throat.

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"Dart-snake. Rather poisonous," the stationmaster remarked, glowering at a long, multilegged animal bunching up for another attack. "Buggers are hard t' spot." The sinuous form leaped. Parson pointed a gloved index finger. Instantly, a slammer drew itself from his belt, bobbed in midair supported by a metallic cable, and fired. The resulting corpse was an oval rug overlaid with a doily of violet blood.

"Darters can't cross the fence; this one must've hitchhiked. Ye have bountiful reflexes, Professor!"

Now I understood that oversized fuel-cell. Parson had a command belt. Guided by glove-sensors, his weapons could kill with inhuman speed and accuracy.

The sand underfoot looked odd. I bent, ran some through my fingers, and sniffed. Salt and herbicides.

Reluctantly, I focused beyond the moat. The rare holovids of Parson's Planet showed nothing like this. Plants were moving; adjusting oversized leaves to hog all possible sunlight, striding on hairy roots to more tempting locations, leaning over to shock attackers with silver sparks. Shoots were sprouting up (and vice versa) like miniature volcanic eruptions. The flowers weren't the galaxy's prettiest, but they were surely the most combative.

These vegetables, evidently, knew what was happening around them. Local potatoes probably had *functional* eyes.

Even trees battled. Some walked, spry as bushes. Most leaves were furiously green, although some coleus-style varicolored foliage blocked a monopoly.

If vegetation was active, the animals were hyperactive! Creatures were running, leaping, slithering. Most were ravenous. Beasts were feeding even as larger beasts were eating them; sometimes those were being consumed in turn.

Animals were mating with desperate haste. Birthing was swift and babies *ran* upon hitting the ground. Few survived.

I watched, petrified. This food chain was ornately interwoven. Most animals were predatory omnivores, craving meat but snacking, when possible, on vegetation between kills. Clawed tentacles were prevalent . . .

Where was so much biological energy coming from?

The answer was blazingly obvious. Gienah, 53 Epsilon Cygni, is an orange-yellow giant far cooler than Earth's Sun, but emitting sixty times more total energy. Parson's Planet, orbiting five AUs away, receives twice Earth's average daily lumens. Organic refrigeration renders it inhabitable. Its prolific vegetation (including seaweed) has evolved an ultraefficient infrared-absorbing photosynthesis, sometimes with photovoltaic aspects. In short, this bio-insanity was solar-powered.

Parson turned to face me. "What d'ye think?"

"Seems a lovely day, Docteh," I replied mildly, defying my clenched stomach. "Wheah awe those AATVs?"

"In the AATV *room*—didn't ye see the dangly sign? I just wanted ye to get the standin' view. Watch behind as we round trip."

As we walked back, I got another jolt. Something had burned huge holes into the dome-monster.

"Don't tell me the station's coated with some cowwosive!"

"A tasty one. Effective, eh?"

Effective, grotesque, and appalling. No wonder that big plastic ring had been attached to my shuttle's underbelly! I'd joked about the poor shuttle needing a hemorrhoid pillow, but, strangely, I hadn't asked what it was for. . . .

The decapus was still trying to bite the roof. To make the sight penultimately horrible, its mouth was gone.

What happened to the liquefied remains of anything attacking the station? Would hidden gutters channel the runoff to some loathsome reservoir? Hadn't Parson said "acid" moat? Maybe that's where—

"Head *down!*" Parson yelled and I

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ducked.

Something red sailed over me.

"A salamandril," my companion proclaimed. "Quite rare. Lucky ye dodged so thefty; those crits get their meat by setting flesh afire."

"How . . . is that possible?" I asked weakly. The animal was burrowing into the sand.

Parson shrugged. "Some chemical they exude reacts violently with a wide spectrum o' organic compounds. We haven't studied them in depth. They be uncommon and we've more interesting beasties to research. But if ye lack protection, look out! Once your skin ignites, the fire won't snuff and keeps spreadin'. They like their supper well-done, salamandrils do, and one touch is enough to kill."

I glanced down at my shoulder. A streak of dampness was drying. Apparently, my fake blouse was fireproof . . . as far as salamandrils were concerned. First good news I'd had today.

Parson's helmet hid his face, but I sensed he wasn't smiling. He uncovered the red creature with a boot that momentarily blushed but didn't ignite. Another slammer blast reduced the salamandril to paste. He then reopened the outer door with a furtively whispered command.

The code word, strangely, was "Bunny." I almost smiled; my current vocal folds had been bioengineered for audio locks.

We re-entered the station in edgy silence.

The AATV was hidden under a tarp. It was four meters long, somewhat narrow, and armored in chameleon plastic coated with translucent grease. I couldn't see any weapons, windows, doors, or wheels.

"How . . . cozy."

"Bit of a squeeze," he conceded, removing his helmet, "but t'will do. She be roomier than she looks. Which reminds me: Our AATVs have heads including dry-showers. You'll fit inside but not gaily, so ye may wish t' relieve yourself before we leave."

"Thanks, but I'm fine."

"Suit yourself. Sure ye want to go?"

"Can't wait. How does this toy move?"

Parson sighed. "On four split-treads and she can fly—briefly. Tamed oxy-hydrogen works pistons and jets."

The treads must have been retracted. "How do we see out?"

"Abide and learn."

Parson pulled a device from a zippered pocket. One end held a flexible tube, which he placed on the AATV, moving it around while squinting at an illuminated readout. Fluorescent light projected a blue bandit's mask over his beautiful eyes.

"Coating be thin," he snapped. He redonned his helmet and snatched a heavy glove off a workbench, placing it on his right hand over the command glove. Then he pulled an insulated hose from the wall, aimed its nozzle at the AATV, and squeezed a trigger. Scorching spray emerged, its infrared flare making my eyes water. Suddenly, the vehicle was utterly shiny.

I'd seen this phenomenon before, somewhere. But before the memory clarified, I was distracted by my own reflection. Distorted by surface curvature, my image was unfamiliar enough for some belated objectivity.

Slowly, over the years, I'd become something terrible. Each "improvement" had left me bigger, scarier, and less human.

The fun-house-mirror wasn't helping. My delicate, pointed ears appeared grotesquely widened, more batlike than vulpine. Only my new eyes were unaltered: big, golden, and feline. I avoided staring into them too deeply. Let sleeping dolors lie. . . .

I forced myself to check my clothing. The blue tunic, brown trousers, and gray belt still looked satisfactorily realistic.

Aside from a backpack, my only gen-

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uine adornments were a golden chain supporting a silvery Ecomission pendant and a whimsical touch: an antique digital wristwatch. In the mirror, my watch was a swollen spider strangling a swollen arm.

The moment of reflection (the AATV's and mine) faded. Parson retested the surface, nodded, and whispered another word I wasn't intended to overhear: "Safe."

The vehicle's roof unfolded; I stared into what was to be home-sour-home for the next few days.

"My cages?" I tried to sound unimpressed.

"Already loaded. They've filled the boot so ye'll have t' carry your back-kit by lap."

I climbed in, sat down, and gawked. Everything looked ultimately sleek, efficient, and costly, especially the translucent virtual heads-up display. My seat was small for me, but oversized for any normal person. It was form-adaptive and immediately began working to keep me comfortable: vibrating, subtly varying shape and texture. The air-filtration system was outstanding; I was hardly aware of my companion's stench when his hood and gloves came off.

As the canopy closed, it seemed to vanish. The AATV was a "convirtual," a virtual convertible. I'd ridden in convirtuals, but here, the effect was persuasive. Image resolution seemed perfect. Subtle breezes from hidden fans enhanced the semblance of open space and acoustic dampers were operating. Sounds within the cockpit now had a subtly anechoic, outdoor quality.

Parson slipped his rifle and battery into floor-clamps. For a few relatively happy seconds, I thought the journey might be easy. Then the doctor "touched" an orange virtual-button.

All hell and its suburbs broke loose. I tried not to react, but Parson wasn't blind.

"Ye can *hear* that?" he asked, astounded.

Pointless to deny it. "That's a—an unde'statement. Please shut it off!"

"I cannot—in fact, t'will soon be louder. These sub and supersonics stand 'twixt us and certain digestive tracts."

With this unsettling news, he touched another button. A pale aquamarine sphere materialized over his right armrest, a sapphire cube over the left. Parson clenched his right hand, inserting it into the shimmering, translucent aquamarine. His fingers opened, the sphere turned ruby, and the vehicle arose on its treads.

This set-up wasn't merely state-of-the-art; it was an up-to-the-damn-minute virtual guidance system costing . . . twice God's salary!

Parson studied readouts, then committed his left hand to the sapphire cube, which deepened to amethyst. Weapons control module, I guessed. But where was the weapon?

A small right-hand gesture rolled us to the airlock. When the AATV got close, the airlock "flashed" itself and opened automatically.

In the lock, as promised, the decibel level soared. I covered my ears with my hands. The outer door opened and we moved rapidly and smoothly over the sand. Parson raised his right arm. We jumped the fence and moat with a roar of burning fuel that added another bad note to the cacophony. And we didn't land daintily.

For the next few incredible moments, I forgot I *had* ears.

I've seen reckless driving, but this took the cheesecake. Parson seemed determined to kill us, deliberately crashing into random monsters and trees—only the impacts were unaccountably feeble, scarcely slowing us. Our journey was dreamlike, dizzying, and zigzag.

Ecomission doctors should renovate my IQ. It took ten terrifying minutes for my brain to work out why it was still working.

"The oil!" I screamed over the noise.

"Ye don't have t' shout, damn ye, I'm

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right here!" Parson's obnoxious voice somehow made *him* perfectly audible. "What oil?"

(We splashed through a shallow pond, spray flying.)

"On the AATV." I couldn't hear my own words now, but I assumed he could. "This vehicle's too slick foah sewious collisions unless we hit dead on; and you keep tu'ning at the last moment!"

Parson flicked his eyes toward me. "Of course. Your 'oil' be named fulleron."

Suddenly, I remembered! Years ago, I'd witnessed a special presentation at Chicago's Physics Research Laboratory . . .

(We skidded between two huge crits; both ignored us.)

A PRL spokesperson had described fulleron as a superpolymer of chained "fullerene capsulettes" with certain carbon atoms replaced by nitrogen, argon, and silver. Historically, buckminsterfullerenes (various molecules constructed as regular polyhedrons of carbon atoms) begot carbon nanotubes, which begot fulleron . . .

(Parson swerved to avoid a harmless-looking thing resembling animated fabric.)

Fulleron isn't merely slippery like your classic C_{60} buckyball. Under laserfire, a molecule-thin layer of fine silver rises to the surface. The spokesperson called this the "floating arc vapor deposition" effect.

The demonstration was impressive. A military laser was fired at a greasy-looking ceramic tile. The tile became so perfectly reflective that the bounced beam punctured a metal plate. . . .

"I know about Fullewon," I said. "I've just neveh seen it applied so . . . libewally." The stuff had proven economically impractical.

Parson's eyes narrowed. "Ye *know?* How?"

Oops. He was probably wondering why a xenobiologist would be aware of an experimental military product—why *had* I attended that demonstration?

"My cousin helped develop Fullewon." Feeble, but the best I could improvise.

I needed to distract him and one issue sprang to mind. "I'm cuwious, Stationmasteh. Why the hell awe you hitting evewything in sight?"

"We have a saying: 'Ricochet be the only way.'"

"Why?"

"Too many moving beings here. If I track toward a clear spot, that spot will likely be filled when we arrive. And understand this: we be armored, but hardly invulnerable. Beasts large enough to spring for a slice o' us avoid the giants, so I aim for giants, who mostly don't care about us. They tend t' be big eaters, if ye follow me. If I miss, we be that much ahead; if I hit, no harm done; we simply track on, proceeding on the bias. Now shut up. Let me concentrate!"

If you get carsick, seasick, or spacesick, don't go sightseeing on Parson's Planet in an AATV. I'd never suffered from motion sickness before, but traveling by caroms. . . .

Gradually, I became more worried about holding my breakfast than about imminent death. I snagged two water balloons from my backpack and drank the water, which reduced my queasiness by a good half-percent. As an afterthought, I stuffed as much of the soft plastic in my ears as would fit, thus simultaneously inventing the galaxy's worst noise-reducers *and* its ugliest earrings.

Terrain was changing. Fewer pools of standing water, calmer vegetables, smaller animals. Interesting.

And here, the struggle for survival wasn't all-out anarchy. Many species, including some plants, worked cooperatively to protect their young.

Parson drove on, ignoring me until he abruptly jerked in surprise.

"Professor, here be an oddity: an adult phobe."

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"What?"

"A phobedon. They usually go for larger meats."

"Wheah is it?"

"Trackin' us."

I twisted around, looking over my backrest. The phobe was a tyrannosaur-style predator. But this fellow seemed larger and came equipped with two long tentacles. Its tusks made T-rex's fifteen-centimeter fangs seem like wee baby teeth.

Despite our sirens and evasions, tentacles began slapping against our vehicle and slithering off. Suddenly, the beast accelerated, lowering its head. Out of the corner of one eye, I saw the stationmaster jerk his left hand backwards . . .

Behind us, horribly brilliant blue fire lashed out. Then, nothing was chasing us. I watched the mushrooming steam and dust for a moment before turning around. Orange afterimages obscured my vision.

I was stunned. This AATV was essentially a dandified plasma-pulse cannon! Military armament reserved for Earth Planetary Security. Something was exceedingly wrong here.

I wanted to ask how Parson had obtained such an illegal weapon, but his impenetrably smug expression warned me. Better to choose questions he *wasn't* expecting.

Travel continued easing. My tour-guide suddenly started talking and forgot to stop.

Initially, the monologue was interesting, filled with historical glimpses and clues to local slang. But I learned (the hard way) that Parson's repertoire was limited. Or maybe his stories just sounded identical. Every tale had one moral: only Parson, his father Daron, grandfather Daffid, or great-grandfather Enoch who had built the station (apparently bare-handed), could handle a crisis.

Partly in desperation, I asked about the station's palpable emptiness and why it had been constructed in such a biologically active area. Wouldn't it be easier to live elsewhere? Maybe even on another continent such as Alabaster?

"Alabaster?" Parson sneered. "That land be cruelly unstable. When a mile-deep crack opens beneath ye, what would ye do? Fall, I warrant!"

Having put me in my place, he resumed the stories or story—without answering the basic question.

Miserable hours passed before I interrupted. "Doesn't this damn sun eveh sink?"

"Do ye jest? Sun sank hours ago, and we'll trip for another two afore we bed."

I regarded the image with new respect; it looked like daylight out there. Only . . . no shadows. I'd let Parson bore me to stupidity.

When we finally stopped, he buried the AATV by running the four treads in opposing pairs. We sank slowly but steadily. He then delicately applied the cannon to surround us with semi-fused earth.

A galaxy of tiny cabin-lights appeared on the now-visible ceiling.

In my lifetime, no music has matched the glory of the sirens dying. Utter bliss! I joyfully pulled out the sad excuses for earplugs.

My companion sighed, stretched, and mumbled something about compressed air and CO_2 scrubbers.

Dinner was packaged rations; we drank something brown. Trash went into a minicompactor under my seat. Parson checked our progress on the virtual chart and performed the challenging feat of looking smugger.

"Not too shabby—near sixty miles! But tomorrow we reach Lake District and slow goin'. By the bye," he asked casually, adjusting his seat for reclining; "I was wonderin' . . . what besides balloons might be in your kit?"

I studied his face. Did he suspect the truth?

That thought caught me totally by surprise. *What* truth?

* * *

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"In my pack?" I fought for composure. "Just the usual."

Was this a test? Eavesdropping on Friskel, I'd learned that Parson had gotten my medical scan. Since the pack was my only obvious hiding place, he would have practically dissected its contents . . .

The stationmaster yawned hugely. "What be 'usual'?"

"You know. Food. Wateh. Um . . . fwuit juice, depilatowy. Toilet papeh, toothbwush, soap. That's about it." Honoring Friskel's request, I overlooked the map.

As I mentioned depilatory, Parson lifted his right hand to hide a smirk; two missing fingers spoiled the subtlety.

I was too upset to care. The depilatory treatment I'd given myself on the *Centipede* would last for months. What had possessed me to bring along depilatory?

What was wrong with me?

This was intolerable! I would soon be alone in a zoological hell and I couldn't even trust *myself*. . . .

Parson unzipped his suit and clambered over his seatback to reach the small bathroom behind us. I felt no need; my body was designed to process nutrients and water efficiently. This was prosurvival in itself, and the less waste I left, the harder I'd be to track.

He returned, dry-shower scented. He wriggled in his seat to get comfy, turned off display and cabin lights, and appeared to fall asleep instantly.

For me, sleep seemed as distant as Rush. My eyes were propped open by disturbing mysteries: the station's emptiness, its peculiar odor. Why had an armed guard been posted in that hallway?

Another issue was more troubling.

We were buried; nearly all sounds involved breathing and pumping: air flowing into the cockpit, the respiration and heartbeat of my unpleasant companion, the gentle creaking of ribs; my own vital noises. Occasional stomach gurgles. Yet no matter how quiet it was, no matter how long I stared into the dark, I couldn't block out one question:

Was I on a suicide mission?

The next morning, after a pitiful breakfast, Parson blasted us from our ceramic pit and we were underway, sirens screaming. My nerves were soon shot even with my improved earplugs (I'd squeezed dabs of food-paste inside).

Parson's driving was almost normal. All too soon, he pulled out his short bag of long stories.

When we reached a lake, I expected we'd fly over. Instead, Parson drove into the water, flooding an internal compartment. Cabin pressure compensated automatically as we sank.

On the bottom, the treads propelled us along at a surprising clip.

An eerie experience! The open-roof illusion made it seem as if clean water was surrounding us, but magically keeping its distance. I had an excellent view, somewhat enlarged (I hope), of a finned welcoming committee.

Finally back on land, we entered another biological hotspot and had to rebound until we came to another lake—and so it went. It was a long, sickening day; when we stopped for lunch, I wasn't interested.

Sure enough, I could squeeze into the bathroom.

We'd parked on a steep hill. Parson magnified the view to study the valley ahead, which did nothing to restore my appetite.

While Parson ate—mayhem didn't bother *him*—I asked about one particularly odd-looking creature. He nodded, expanding the image for a close-up. My mystery beast was a brit called a "draper." I'd seen dozens on our journey, and noticed how careful he'd been to avoid hitting them.

The draper had a bizarre means of locomotion: depositing parts of itself on other parts. Its "front" end lengthened in gushes while the "rear" end shrank. Sometimes it resembled an animated,

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horizontal stalactite, other times . . . drapes.

It was speckled with turquoise droplets and the ground bubbled as it passed. Other species gave it a wide berth.

I asked the logical question: were these brits acid-covered? Parson found the idea so amusing he nearly choked. I wished I'd been funnier.

"Hardly, Professor. Drapers ooze deepest alkali. Not much chews on *them*."

"Oh. Thought I'd found the sou'ce of the station's acid." His grin widened. "It's not impossible, damn it! I'd expect you to use animals in nasty ways."

Surprisingly, Parson arrested mid-chuckle. Yet Ecomission rules are tolerant—perhaps too tolerant—of colonists exploiting wildlife if there's no danger of ecological disruption or species extinction. I'd seen enough drapers to discount imminent extinction.

"We synthesize our acid," Parson stated unnecessarily. "I'm done, let's go."

The next morning started badly with another horrid breakfast. When we surfaced, Parson glanced around grimly and released "safety webs." Apparently, shoulder straps couldn't handle slipping and sliding added to the usual bouncing and jouncing.

The webs were gossamer cocoons that held us firmly. Mine was uncomfortably small.

Today, some collisions weren't so mild; fortunately, our chariot was tough. Drenching rains brought out aggressive brits resembling wingless, armored, wolf-sized mosquitoes.

All in all, a day worth forgetting.

The journey's final day was overwhelming.

It was drizzling as we entered a magnificent forest strangely devoid of hungry life. Parson called this the "Trap-Door Jungle." The enormous trees, whose arching branches created a semi-closed canopy, stayed rooted. We could drive like sober folks!

Parson adjusted the sirens to emit two tones: one at about six Hertz, the other at fifteen. The result simulated riding an earthquake.

"Here we enter the herd-runs," he explained. "Herd beasties gang in vast numbers; they stampede, tramplin' anything they overtake. Then they cut back, feedin' on remains."

"This noise fwightens hewds?"

"Hell, no! It scares trap-door crits who be canny enough to hide until a stampede passes. I'm duplicating a herd ground-shake."

"Twap-dooah . . . what? What kind of cwits?"

"Wait 'till we come to a long-enough clearing."

Soon, Parson found a path fit for his demonstration. He damped the sirens, rapidly returning his hand to the guidance module; acceleration flung me backwards.

"Watch t' rear."

I twisted around to face a paranoid's time-and-motion study. Multitudes of round or rectangular plates set into the earth had appeared. On the ground we'd just passed over, these doors were barely up. Farther back, the plates had risen enough to reveal dark holes. Still farther were open holes whose resident monsters were emerging. From that point on . . . a sea of monsters.

Every crit seemed unique, impressively ugly, and lethal.

An especially athletic denizen leaped prodigiously, landing on our roof. The convirtual effect provided a close-up of snapping jaws, multiple tongues embellished with miniature teeth, and a wash of yellow drool.

I had one heart-stopping moment to appreciate all this before the monster slipped off, its dozen spiny limbs flailing. Concerned neighbors emerged with eye-blurring speed, but not to comfort the dazed creature; it was half-eaten before we moved twenty meters.

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"You can sound the siwens again," I remarked thoughtfully. "We have plenty of fuel, I hope?"

Earth and Parson's Planet are similar in atmosphere, gravity, and rotational speed. Parson's year is six times longer.

Both planets have oceans, volcanoes, magnetospheres, and a large moon; their respective suns rise in the east (as defined by magnetic north) and set in the west.

Yet, when we finally arrived at Albamy Jungle, it seemed the most alien environment I'd ever encountered.

Parson, recounting another cloned story, muttered, "Here be Albamy." The monologue resumed and I paid even less attention than usual.

The place suggested an underwater forest. Gienah's actinic light, filtered through millions of leaves, dimmed to emerald. Undergrowth was minimal. Enormous, permanently rooted trees were lined up in neat rows, verdigris-colored trunks practically touching; between rows was a long, wide corridor floored with dead leaves and moss: a giant's carpet.

Spectacularly colorful fungi sprouted, yellow, blue, and scarlet.

Above us, trees competed, but their branches were so intertwined, wavelike movements were generated, dropping scores of leaves as they passed. I got the strongest impression of watching ocean breakers from beneath.

The jungle appeared infinitely more civilized than the station's demesne.

"Hunter territory," Parson observed sourly, then he snapped to attention. Two green squares adorned his display, representing two large groups of large animals. The squares were converging on the triangle signifying our current position. My companion fell silent, tensely studying the passing landscape.

"This'll do," he said, halting the AATV, then backing it smartly into an atypical space between trees, oddly bright and densely walled by branches.

Parson killed engine and sirens, grumbling that such sounds *attracted* danger here: herd-predators.

His timing was inspired. Two armies of crits coming from opposite directions stampeded down the corridor. Each herd kept strictly to one side.

Darwinian protocols?

Even inside our vehicle, rumbling was intense. I shouted, asking what happened if a herd encountered, say, phobedons. A pile-up?

He hollered back that the herd would "flow around" uncrushable obstacles, but I'd be surprised at how big such obstacles had to be.

The galloping animals looked like . . .

"Wambs!" I exclaimed. "Which kind?"

"Bright's rambs, Professor; three hands larger than most and with wider dorsal mouths."

"Sidehunteh meat?"

Parson's jaw muscles began twitching like a bad actor's. "Hunters feed on rambs, true. Here be a . ... symptom of a strongly fecund world: meat-eaters eating meat-eaters." Another evasive answer for the collection.

"Wheah was the last sidehunteh sighting?"

"Not far. Listen, we've no time for idle chit, I'll flash the place, then we must unload your cages right quick. Ye might prefer bolting your eyes." He donned his headpiece.

I took the advice; even through lids, the blue light stung. When I dared look, the closest trees were burning, those across the corridor were smoking, and the nearby fungi were history. A dazzling patch of late afternoon sky shone directly overhead.

Parson had fired in a hemispherical pattern, vaporizing a circle of canopy. As I stared, aghast, the fires were smothered by watery sap oozing from damaged trees.

"Make quick, I say!" Parson pulled on his gloves. The roof opened and we climbed out. "Push that lever," he ordered, indicating a new virtual button

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on the vehicle's stern. Evidently, his belt knew when he was simply pointing.

The button opened a wide compartment containing three cages: long gray tubes of pressure-set memory polymer stabilized by end-caps.

"Get 'em out *lively!* " he hissed, head constantly turning.

I grabbed two cages, set them down, and was reaching for the third when the c-belt whined. To my chagrin, Parson had noticed trouble first.

He was pointing everywhere like the ultimate tourist. One weapon after another levitated, aimed, and fired even as Parson doomed his next target.

Those targets made my feet itch to unfold . . . or run. Running wasn't acceptable, yet I hated to reveal my hidden assets.

But Parson was in trouble; ten human-sized but terrifying crits had attacked. Now, the three survivors were charging him. He wouldn't get them all in time.

Without consciously deciding, I leaped, barely clearing Parson's head. As my body blocked his view, I unfolded one foot, releasing its long, razor-sharp cutting-bone. I twisted in mid-air, kicking in a wide arc.

While Parson blasted the remaining crit, the two beasts I'd decapitated slumped, twitching, blood-geysers squirting from open necks.

I felt ill. I'd come to *save* animals. "You all wight?" I asked in an overly high voice.

The stationmaster was trembling. "Aye! Thanks for your . . . timely assistance."

"Likewise." I considered the bodies and shuddered.

For days, I'd been mentally grouping Hame's incredibly diverse species into "clades": organisms whose similarities imply a common ancestor.

One likely clade resembled the coelurosaurs of Earth's Cretaceous period. Unhappy convergent evolution; coelurosaurs had been gifted killers. The corpses approximated that supposed genius among dinosaurs: troödon—the "wounding tooth" coelurosaur.

"These things have a name?"

"Dinoreps," Parson replied hoarsely. "Generic."

"Wheah did they come fwom? You'd just blasted!"

"Hidin' behind boles, maybe."

"Behind twee twunks?" The trees were packed too tightly for that to fly.

"What'd I just say?" he already sounded more like himself. "But perhaps . . . I've underjudged ye. Ye'll surely die soon, yet maybe ye'll not be killed by anything *small*."

He leaned over, apparently to inspect my hands and feet. Wondering, perhaps, how I'd produced clean cuts with blunt objects.

I glanced downwards again. "Do all native cwits have violet blood?"

"Only those using vanadium to carry oxygen: dinoreps, dart-snakes, chewders and the like. Hemotodes and bell-flies use copper—gives 'em greenish ichor . . . other crits use iron like—wait! This be no place for a dangly *biology* lesson! I'm off, whilst I can. See ye in a fortnight. If ye still want to stay?"

"Wouldn't miss it."

"Any last questions, Professor?" Faint emphasis on "last."

He'd recovered his poise. Although his face was hidden, I knew that unbearably smug expression had resurfaced . . .

"Yeah. You keep using 'dangly' as an obscenity. Awe you having some ewectile dysfunction?"

A childish sally. But Parson jerked as if struck, climbed into the AATV, rolled from the parking place, and was gone.

I had severely mixed feelings. In part, I wanted to run after him, begging to return to the station. Another part never wanted to see the inside of that accursed vehicle again.

In the distance, two-tone rumbling suddenly resounded. The noise faded, and apparent peace filled the forest. I removed my earplugs with shaky fingers and looked around warily.

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The leafy waves high above even *sounded* like combers rolling onto a beach. A melodious hooting began; small rustlings spread. Gentle breezes blew the carrion scents away from me. My nostrils were filled with smells that were fresh, green, kissed with chocolate.

The lowering sun managed to poke an oblique orange finger through the canopy to the ground, turning flying bugs and suspended dust motes into temporary shooting stars. Everything was incredibly tranquil.

I looked closer; insects were feeding on each other exuberantly. From afar, a percussive sequence echoed. Was some Titan making popcorn? I was alone on one hell of a planet, and night was coming. I spun around twice, making sure nothing more ominous than darkness was creeping up.

"What now, Susie?" I wondered.

The parking place was pebbled with annoying, walnut-sized bumps, but it seemed my only possible campsite. So I began hauling bodies (and parts) into the corridor. The corpses were unexpectedly light; hollow bones, I imagined. Like mine.

After finishing that grisly task, I examined my only hope: the cages. Each one would spring into its intended shape once its end-caps were removed.

Very small, faint numbers were embossed on the cages. They were numbered one, three, and four.

Aha! Now I could guess which to open first.

I pulled both caps off cage one, jumped back, packed the caps away, and waited. Nothing happened.

Oh dear.

Mindful the thing might suddenly expand, I worriedly peered into an open end and spotted an abnormality: a yellow o-ring, so sticky it took determination to pry it free. I wasn't sure what to do with it, so I shook it off my hand.

Another o-ring squatted in the far end. When I withdrew it, the cage transformed so quickly it clobbered my nose as I sprang backwards.

Strange results! A fair-sized dome whose surface reflected like heated fulleron stood there. I gawked at a curving jungle, complete with bloated hybridim. The very model of anxious astonishment, I was crushing an o-ring and my mouth was open.

I fixed my mouth, discarded the ring, walked closer to the cage, and touched it. The material felt incredibly slippery, like flowing liquid.

"Slick," I whispered, both meanings intended. Frictionless surfaces were becoming a fad. . . .

Here was shelter; but how was I supposed to use it?

A reflected crit was suddenly behind me, its skeletal arms terminating in machete-length claws. I whirled. The beast hissed, hastily retreating. Pumping those thin arms sprinter-fashion, it disappeared into the branches and vines that seemingly walled the end of my campsite.

I followed cautiously, pushing aside vegetation and soggy webs to discover another tree-lined corridor beyond the barrier. *This* is where the dinoreps had come from.

"I'll be damned," I muttered, intuiting the Jungle's layout. "It's God's bowling alley. With twees instead of guttehs. Ten thousand lanes, no waiting."

The image was so compelling, I released the branches carelessly. Before I knew it, a leaf-colored serpent had its fangs sunk into the seventh finger of my left hand.

If Snaky had expected to chomp and run, it must have been surprised. I certainly was. The reptile was choking, writhing while dangling to the ground because my littlest finger had stretched like warm toffee.

The crit spat out its mouthful, gave me a dirty look, flung itself onto a branch, and corkscrewed away. I stared at my left hand.

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Stay *awake*, Susan, I warned myself. Elastic fingers can wait.

I anxiously inspected my surroundings. Five meters up, branches were crawling with . . . serpents? No, animated vines; the teeth had fooled me. I blessed whatever was keeping them up so high.

Unable to help myself, my eyes locked onto my hideously stretched-out finger. Why didn't it hurt? And when, I wondered uneasily, had I gotten four extra digits, and why? I touched each one. None felt a thing.

They were bogus. I wiggled my real fingers, the fakes wiggled along. Memory polymers responding to pressure changes?

What the *hell?*

I tugged the ruined spare completely off, rolled it, packed it away, and returned to my potential future home.

I tried pushing my way in; my hand kept sliding off. Then I tried voice command, which seemed silly and was.

Finally I considered the discarded o-rings. Experimentally, I stacked them. They flowed together like drops of quicksilver, creating a larger ring. Progress! Maybe.

I eased the circle toward its own reflection. It reached the cage . . . and went though! My arm appeared amputated at the wrist. Hastily, I withdrew it, hand still nicely attached. This ring was a key ring.

Holding it before me, I moved forward. Through the looking glass I go . . .

The surface parted, I was in! I released the ring and a breath I'd apparently been holding for days.

From inside, the membrane was pleasantly translucent, somehow admitting air and light. I would have appreciated it more, but something strange happened.

Fiery cursive letters appeared in midair, spelling: "Alice in Wonderland, go through the Looking Glass."

I stared, unable to comprehend how something I'd just been thinking could . . . manifest.

Then I recognized the handwriting: mine. Whatever crazy plan the Ecomission had concocted, I'd evidently been in on it.

Why couldn't I *remember?*

Some letters were fading. I tried to touch one, but when my hand approached, they all vanished. An instructional hallucination? If so, I'd ruined it.

No sense worrying, I told myself. If it happens again, just watch and see what develops. Meanwhile, why not slip into something comfortable?

I removed my backpack and let my mimetic "bubble" relax. Freedom! My bubble, the latest addition to my biological repertoire, had been mimicking clothing. It became twin blankets of limp, gray skin attached to my shoulder blades.

Recently developed "mediating cells" along with AIAs (Artificial Instinct Algorithms) now allow Hybridim to be equipped with non-terrestrial attributes, invisible to standard medical scanners.

My foot-blades were those of a Conibel razorlion. My bubble was the protective cloak of a Hopping Mime from Conibel's Forbidden Forest.

I allowed blood to flow into certain channels. Bubble-sections began lifting, transforming into iridescent, tightly folded wings, which fluttered slightly with every breath.

No, I can't actually *fly*. . . .

Heavy rumbling inspired me to grab the ring and step outside. There was nothing new to behold until three medium-sized dinoreps joined me in the campsite. A split-second later, four tentacled citizens appeared, along with one mobile brit that was all waving roots and whipping branches.

Expecting bloodshed, I backed away, but nothing happened. Each species ignored the others, avoided eye contact (easy enough for the brit), and took up as little space as possible. My general impression: an elevator crowded with shy

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strangers.

When the rambs arrived, they didn't trip over the corpses I'd left. The leaders used their twin elephant trunks to lift the bodies, hurling them up and backwards to land on the "cranial knives" of following animals. The bodies were carved progressively; prehensile tongues pulled bloody ribbons into hungry mouths.

The rambs had two eyes facing forward and two on their backs near their mouths, which were constantly open, gathering falling leaves like whales gathering plankton.

Nodding to my elevator companions, I muttered, "My flooah," reentered the cage, and dropped the ring. The fiery words were back! Same nonsensical message: "Alice in Wonderland, go through the Looking Glass."

Again, some letters faded, but this time I merely watched. Finally seven lingered, spelling "iewdrkn," which remained incomprehensible even when the "w" rotated to become an "m."

Then the letters switched positions, settling into "Drink me."

Suddenly, one scrap of information burned its way out of hiding, leaving me shaken and sweat-drenched. But knowing what to do!

I opened my jaws, let a specialized lingual muscle relax (another relief!), and pushed air down an artificial channel inside my tongue. A thin, flexible, medically undetectable tube shot from my mouth. I caught it.

"Will wonders never cease?" I commented quietly. But the words came out crisp and clear . . .

I could talk normally! "All right!" I cried out, exaggerating the "l"s and rolling the "r" outrageously. I began dancing around, grinning, mouthing formerly troublesome words. But when "Parson" accidentally emerged, my joy popped like a balloon.

Amber liquid filled the tube. My momentary inspiration had faded along with the letters. But the message had been explicit.

I broke the tube's seal and gulped its bitter contents. Time held its breath. . . .

Reality stuttered. A sound like the word "wow" was repeating endlessly. Cracks in thin air opened and collapsed, providing glimpses of impossible realms. I must have fallen, but I can't remember.

Inside my head, a golden chrysanthemum of mental sparks ignited—which *hurt*. I sensed that my body was rolling, shaking. Then I passed out.

Drink me, indeed. It had been lousy advice, even for Alice!

I woke up, opened my eyes, and sat up gingerly. Reddish light was still filtering into my lair. I gazed blankly at the empty tube beside me. Then the blow fell. The sheer impact of restored memory almost knocked me flat again.

Everything was rushing back . . .

I *wasn't* employed by the Ecomission's endangered-species branch. My paycheck came from its enforcement arm: the Ecoservice Agency.

And I wasn't just another xenobiological troubleshooter. My title was Special Agent Extraordinary. I'd been so good at forensic ecology, the Agency had declared me its premier investigator.

In practical terms, this meant that Bluff and Washington, my immediate superiors, only sent me into the worst situations on their long list.

Responsibility hit me like a ten-ton anvil, but without any matching increase in courage or determination. I just wanted to go home.

And what I *didn't* know was appalling. My initial briefing had been deliberately skimpy; I hadn't put myself through the wringers of voluntary amnesia and forced recovery for laughs.

Sometimes ignorance is the only defense.

The verifier, all-but-omniscient descendant of the twentieth century's uncertain polygraph, concurrently records,

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analyses, and interprets brain waves, eye-movements, skin reflectivity, heart rate, saliva volume, etc.

The abuse potential of such machines is vast. They are only legal on Earth, in specific situations. With them, it's possible to ferret out anything from industrial secrets to a political opponent's election strategy.

Sadly, illegal machines and troublesome planets are often married.

So, just in case, I'd arrived as uninformed as practically possible, my mind conditioned to shun those few secrets I'd had to carry.

But memories get attached to other memories. I'd had to temporarily forget elephants to hide peanuts.

Now I craved information. And with suppressed memories breaching like whales, I remembered my biggest secret. . . .

Another stampede interrupted my congealing plans; its rumble included a distinct rhythmic pulse. Presumably, these weren't Bright's rambs. Would I become a connoisseur soon, able to distinguish species by rumbles?

Then another noise intruded: a disconcerting clicking, moving damn fast. The desperate chorus of snarls and squeals pulled me outside, ring stuck to my chest.

All that remained were carcasses gruesome enough to make me lightheaded. Parts were scattered: a leg here, a head there. Remember that old anthem? O'er the ramb parts we watched . . .

I forced myself to walk over and assess a random wedge of meat, seemingly cut with immense serrated scissors.

Crits and brits were emerging from the woodwork now, feasting. From the north, a machine gunlike popping made me flinch. It was high time to—

I turned. Eight dinoreps were behind me; similar to those I'd decapitated, but bigger. Two of them eyed me, then looked away, meandering closer as if by accident. Various gory tidbits slowed their progress . . . insufficiently.

The remaining six hopped directly to my cage. Something must have smelled appetizing because they kept sniffing.

How awkward.

Searching for an alternative to slaughter (likely my own), I repressed squeamishness and gathered up two dripping heads. I then strolled toward my campsite, as casually as rubbery knees would allow.

Every dinorep turned to face me. The nearby couple was directly in my path but took several hops backwards as I approached. I kept a steady advance. Ha! These beasts had never seen anything like *me* before! To make myself appear larger, stranger, and more dangerous, I stayed upright, sending random patterns and colors swirling though my wings. I let them unfold halfway, and gave my audience a shark-toothed, insincere grin.

Apparently, I didn't look scary enough. The two closest predators stopped retreating. Both took a single bound toward me and stood three yards away, lime-green eyes glittering unnaturally in the twilight.

They lowered their heads, adjusting their rear ends like cats about to pounce. Their mouths opened extra wide and—the larger fangs were *writhing* like beckoning fingers!

Uneager to see what other tricks these crits knew, I bowled a head underneath each. As they hunched over to sniff my offerings, I leaped onto the nearest scaly back, using it as a springboard.

I'd made spectacular jumps before; mortal fear made this one outstanding. I cleared the wriggling, snapping fangs with angstroms to spare. Luckily their reptilian arms were short.

In midair, I snatched the ring off my chest, held it beneath me, and fell through the dome's top. The floor was harder than I remembered.

While rubbing my hip, I made a decision: no more impromptu excursions!

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The dinoreps knew where I was. They grunted like lovesick alligators, testing the dome with clawed feet. I sat back, sifted through reawakened memories, and watched the hideous shadows.

Some wit once described a T-comm as "two tin cans connected by a superstring."

Well, sort of. T-comms are notorious for poor sound quality; their signals modulate too randomly to filter out extraneous noise. Half the time, noise *is* the signal and communications depend on psychoacoustic perception. But such transmissions are secure and instantaneous.

They utilize "transfinite waves," virtually massless, open strings whose ends can only move along a four-dimensional manifold (called a D2+2 brane) where two dimensions are the ultradimensions of K+ string theory (used for superspace travel) and two belong to the usual gang of six "compactified" microdimensions.

T-waves (ultrawaves) are almost infinitesimally short and rigid from the standpoint of superspace and can be almost infinitely long and flexible from an ordinary perspective. Once such a wave is established, it will automatically adjust to changes in transceiver positions.

Move an ultrawave and the entire wave moves en masse. Jiggle it, and the far end—even if ten million parsecs away—will simultaneously copy the jiggle (with small random variations produced by shifting time-flow inconsistencies).

T-comm video is coming, but current prototypes aren't ready for mass distribution. People might find it somewhat disconcerting to be viewing a loved one and suddenly see them upside-down, or in any number of vivid cross-sections.

Outside, my unwelcome visitors had gotten unwelcome visitors. Hints of spiky silhouettes were cast onto the thin but (so far) impenetrable membrane of my home. I tried to ignore the sounds.

It took only fifteen minutes to assemble the gizmo.

The recipe required cage end-caps for mixing wet ingredients, certain foodpastes, one kind of depilatory, my medallion and chain, and all four fake fingers. The "exciter" was my ridiculous watch, which had kept lousy time anyway.

Soon, metallic threads (macromolecular nonsymmetric ionic crystal lattices for the stuffy) were sprouting from the medallion in the swirled herringbone pattern of a T-wave antenna.

Apple juice was the activator; I applied enough to the battery for about twenty minutes of power. While waiting for the charge to build, I idly snacked on paste from a black-labeled tube. Some chef wasn't destined for greatness.

The animals outside were gone or dead; the light was dimming. Perhaps stars were twinkling in the hole overhead. I tried to remember if Diana, the local moon, was due to rise. Fantastic colors suddenly splashed my dome; a "fireworks" plant must have released its incandescent spores.

This time of year, central Hame would be a thrill for sightseers. Naturally occurring nightly light shows could distract tourists from mundane cares such as their own impending deaths.

A sudden crackle made me jump.

"Susan? We're getting a signal . . . is that you?"

"Freddy!" I cried. "How *are* you?" Being in touch with *Centipede* made me feel like singing. Hymns!

"Sue! You sound like yourself again!"

"Back to abnormal, I'm happy to say."

Captain Fred Becker and I had been working together for six standard years; he was the best friend anyone could want. When we'd first met, I'd still looked human . . . almost.

"Thank God you're alive."

"Nice to hear your voice, Captain." That was putting it mildly. "You're coming in fine, how about me?"

"Loud and unclear."

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"Why *are* you on the Comm, Freddy? Get demoted?"

"We've been listening for you 'round the clock, dear. What'd you do, *crawl* to Albamy?"

I filled him in.

"We were worried sick," he confessed. "Just a sec." I heard Kit Kobe's familiar baritone in the background but static blurred his words.

"Sue, Kit's here. Can you help him pinpoint your location?"

"Can he hear me?"

"No, I'm on headphones."

"Tell him I'm about 130 klicks due east of the station, directly beneath a large hole in the canopy."

"That'll help. But there are dozens of holes in your area. Stand by."

Minutes passed slowly, but I didn't mind. I felt as if I'd been rescued.

"Got you! We sent bleeps through every bleepin' hole around, and finally got a bounce from your dome. The hole above you is especially big and round. What causes them? And why is yours different?"

I couldn't answer the first question, so I jumped on the second, eager to mention the plasma-cannon.

Silence. Then, "You're kidding."

"No, but the gap might come in handy. Igor can fit through easily." Igor was our robot shuttle. "Trust me: Don't send people!"

The hole might even have another use. . . .

"Sorry, Sue, there's a few, uh, scorpions at our picnic. For starters, jungle plants grow quicker than bamboo. Your gap won't last."

"Plasma blasts, Freddy, *cauterize* vegetation."

"Maybe," he allowed. "But forget Igor; got some harsh news, dear. There's been an accident. The main shuttle is totaled and Bill Ku got hurt."

Dear Lord! "Is he all right?"

"Broken ribs, assorted lumps, but he's healing. And dishing some cock-and-bull about flying squids."

"More an octopus, actually. Just one and it wasn't exactly flying."

"Oh? He claims it was bigger than my damn mortgage! Says he almost hit *another* one on takeoff. Got so rattled, he screwed up his docking."

Suddenly, I had what you might call a diminishing sense of rescue. "Do tell."

"Bill crashed into Igor—probably saved his fool life. Susan, I can't retrieve any, uh, specimens until another Edgeship arrives."

"How about repairs?"

"On Earth, sure."

"Well . . . my hypothetical specimens should keep indefinitely in suspended animation. Theoretically."

"Screw the sidehunters! I can't retrieve *you*. Unless—"

"Unless?"

"We take *Centipede* itself down."

My eyes flooded. "Thanks," I managed to choke out. "I love you too. But you know I couldn't allow that." Edgeships aren't built for planetary landings.

"Shit. Then you'd better . . . borrow a station shuttle if you want to get offplanet soon."

"If only."

"Buck up, Sue! You always manage to do the undoable. Say! After your sidehunters are in suspension, couldn't you just . . . suspend yourself? That would make waiting easy."

"Wrong metabolism. Besides, Albamy is no place to be helpless."

"Pity. What's it like?"

"Lord! Think Swatt—on steroids! Don't tell anyone, Freddy, but I'm petrified."

"That," he lowered his voice, "doesn't sound like you. It's not really worse than Swatt?"

"Albamy is horrendous, but the station's neighborhood is unbelievable!"

"Anything I can do?"

"Just . . . get my briefing."

"Right."

"Have a pencil?" I asked. "The code is: 41592653589."

"Got it. I'll go fetch. Meanwhile, gos-

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sip with Kit. He's making mysterious obscene gestures, but maybe he just wants to chat."

"I'd like that."

"Susan?"

"*Konbanwa*, Kit-san!"

"Good evening to you, too, Su-san," he chuckled. Kobe was *Centipede*'s topological navigator.

"How are things?"

"Good, now that you've made contact. Between us, Fred's been a stinker."

"He tends to fret."

After a slightly awkward moment, he remarked, "Has your diction improved or something?"

"*Arigato gozaimasu*."

"It *has* improved!"

"Easiest way to cure a speech impediment is to remove the impediment."

"What?"

"People with tubes in their tongues shouldn't throw speeches."

"Do you mean—ah, our peerless Captain has returned. I'll give you two some privacy. *Jaamataashita*, Susan."

"*Jaamataashita*." I was pleased he'd said "so long," not goodbye.

"I'm back," Fred muttered, "and we're alone. I previewed your printout. Heavy stuff, Sue! Got any . . . specific questions?"

"Is Parson Pharmaceuticals *obscenely* rich? I can't believe how—"

"The company isn't even profitable anymore. Competitors are duplicating Parson's drugs as fast as he can release them. But there's a better question."

"Then—oh, damn! Hold everything. I'm about out of juice . . . literally. I'll call back ASAP."

"I'll be here."

The ghostly, pitch-shifting howls that accompany ultrawave contact faded and my terrible sense of isolation and loneliness returned.

After pouring more cider into my homemade battery, I measured my troubles. Ku's accident had complicated matters. I couldn't finish my job without a shuttle . . .

But why worry about that with closer hurdles to clear? Whatever my orders, they'd certainly include capturing sidehunters. How could I hunt them without being hunted?

One possibility leaped forth, but was I skillful enough to—

The T-comm crackled.

"Freddy?" I asked.

"Expecting strangers?"

"What's the better question?"

"This: who told us that sidehunters were endangered?"

"I . . . assumed Ecomission inspectors—"

"In the past ten standard years," he interrupted, enunciating precisely, "only one inspector has landed at Parson Station. You."

"*What?* The Council mandates yearly inspections at every frontier station!"

"An oversight, perhaps." He sounded uncharacteristically humorless.

"Therefore our information is—"

"A decade stale, generally speaking."

"So who spilled the beans about sidehunters?"

"Occam's Laser suggests an anonymous stationer leaked it . . ."

"Oh."

". . . to the Interworld Council."

"Not the Ecomission? Are you—"

"Wait, Sue. Take a minute and mull."

Odd advice. Something was seriously worrying Fred. Why was he being so circumspect?

This was looking grim.

Obviously, the Ecomission had intentionally omitted its inspections, which suggested a most distressing possibility. If corrupt officials had planted a spy on the *Centipede*, I needed to proceed . . . delicately.

"Who cut my orders, Freddy?"

"Charlie Bluff's signature is right here."

I understood him: *only* Charlie had signed. Yet this operation should have

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required two additional signatures from Ecoservice Oversight bigwigs.

Incredibly, Charlie had finagled a private mission. The implications frightened me worse than any dinorep.

The rest was simple and distressing.

A survey-ship discovered Parson's Planet (Gienah V) 180 years ago. The seven-person ground team landed on comparatively harmless Alabaster. Three lucky souls even managed to depart, eventually submitting a thoroughly discouraging report.

The planet would have been written off, but a survivor sent biological samples to Scotland's Parson Pharmaceuticals. These specimens showed such extraordinary promise that Enoch Parson dropped everything to build a station on Gienah V, making it his new headquarters. (If Enoch matched his great-grandson, he'd probably dropped a tactical nuclear bomb to give his prefab workers elbowroom.)

After the Interworld Council was tipped off about the sidehunter problem, Councilor Wu informed the Ecomission. The ISS *Fling* was dispatched to study the matter . . . mostly from orbit.

But a hybridim aboard, Investigator Bobby Gaines, made a solo trip to Albamy. He lived long enough to partially dissect a dead ramb, load tissue samples and what was left of himself into his shuttle, return to the *Fling*, and make a brief report.

He'd been incredibly lucky in a way. He'd actually seen a sidehunter hunting, concluding that the technique employed would only work on one kind of animal: the Jopper's ramb.

His final words were his guess that sidehunters were endangered because Jopper's rambs were getting scarce.

After the *Fling* returned, something strange happened. After sending Gaines's specimens to Mars for storage, the Ecomission ignored Parson's Planet for three years. Perhaps two species would have vanished unnoticed, but Colonel Bluff discovered a hidden file. . . .

Apparently my job was fourfold: save the sidehunters, investigate the station (that's why I'd been dropped there), determine the fate of the Jopper's ramb, and—the painful part—indirectly investigate my own organization.

After Fred signed off, I went straight to bed and dreamt that my dead husband and little girl were trying to warn me about something. Their lips were moving, but all I heard were the ghostly wails and squeals of a T-comm when no one is talking.

I awoke exhausted despite a comfortable hammock I'd improvised from my mimetic bubble. This bubble, I thought, has a thousand uses. How about one more?

I stood, reshaping the tissue into a formless shroud. It was tricky enough to duplicate the modulating appearance of a draper, but those alkali droplets were little bastards.

Realistic transparent drops need lens-like attributes: focussed light, magnification of underlying surfaces, highlights, subtle shadows, color changes . . .

Praying the natives weren't art critics, I settled for stationary blue bumps.

I practiced moving "drapes" around, ate breakfast, and resumed practice until the imitation was automatic. Finally satisfied, I extended the shroud to cover my entire body, including my head. From inside, the tissue was sheer enough to see out.

Next step: testing.

I'd come with no apparent shelter or weapons because we hadn't wanted the stationers to perceive me as a real threat. But I sure wished that squeezing together food-pastes would miraculously produce, say, a burst-laser.

After checking for suspicious shadows, I took a deep breath, grabbed the key, stepped outside, and formed my draper-shell.

Yesterday's gore was gone. Green

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shoots, encouraged by the gap overhead, were springing up underfoot. And I'd forgotten to bring my lawnmower. . . .

I searched for a test subject.

One was waiting in the corridor: a six-legged fellow master of disguise with phony leaves hiding its broad back, a deformed crocodile's jaw, and more teeth than seemed decent.

Watching the beast through my stretched-out bubble, I approached warily.

Damn, that animal could scoot! It took one look at me and darted off like a cheetah. My masquerade was a success!

Delighted, I experimented on other crits. More success. Finally I felt confident enough to go exploring. I kept to all fours, alert for rumbles.

Before I could panic about being too far from safety, a nook between trees appeared, so similar to my campsite it even had, implausibly, another canopy-gap overhead! Someone should post a sign, I decided. In event of stampede, head for nearest refuge.

We jungle crits need our escape valves.

Go ahead: label me Hybridimmus Moronicus if you must. Considering the growth rate of Albamy plants, why hadn't I noticed the glaring inconsistency?

I had. But I'd figured stampede refugees kept the nooks cropped just as herds kept the corridors clear. This assumption, of course, ignored a few holes. . . .

As twilight slithered in, I hurried home, wondering if sidehunters were already extinct. Quixotically, I assembled the big cage anyway. Would it contain any specimens before Parson returned?

Would Parson return?

The third "cage" was my salvation if he didn't. I gazed fondly at the unexpanded plastic tube, even waving to it while entering my dome.

I was unknowingly waving good-bye.

* * *

Around midnight, a sharp detonation blasted me awake, heart thumping. Two thumps later, the night bellowed concussions. Moonlight dimmed. My dome was suddenly batted into the air, coming down hard enough to send me sprawling.

Was I under attack? I couldn't *think*.

Then it was over. The abrupt silence had that stunned quality following a heavy bombing.

I stood up shakily. The moon, Diana, had reemerged; I stepped outside to join her.

Not one fallen leaf, twig, or bug lay on the campsite floor. The new shoots were gone. But it wasn't clean. Evidently, the walnut-sized nodules had burst; shell fragments littered the area. What had been inside those . . . artillery shells? How could anything so tiny have caused so much damage and then vanished so completely?

Trees abutting my sanctuary appeared *whittled*, trunks stripped to bare wood and branches eaten away. The alarming vines were gone, teeth and all.

Overhead, the canopy-gap was bigger.

I bent down, scraping away a layer of rich loam. Under the surface, new nodules were forming. A cycle was underway . . .

Reluctantly, I examined my cages. Both assembled structures were shiny and undamaged, protected by sheer lubricity. But, as I'd feared, the unassembled third structure was eroded and distorted like something caught in a combination tornado and sandstorm. Would it remember its primary shape?

What the *hell* had been in those pods?

Several badgerlike crits scampered past me and threw themselves on the ground near my dome. They ignored me, yawned, and then apparently fell asleep. A moment later two medium-size dinoreps appeared, repeating the performance except for the yawning.

I'd *never* had company except during stampedes or when something was hunting me. But crits kept arriving. Pay-

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ing no attention to the potential meals around them, each found a spot and settled down for a good night's snooze. Evidently, word was out that Susie's place was safe . . . for tonight.

Survival needs make strange bedfellows.

There wasn't much room left at the inn; I returned to my dome before overcrowding forced me to use sleeping killers as stepping-stones.

I reported the latest bizarre events to *Centipede* and tried to sleep.

Most hybridim have crazy dreams. Ecoservice psychologists think this is a consequence of Artificial Instinct Algorithms, which allow humans to control nonhuman attributes. AIAs are like having scraps of alien habits hiding inside your brain.

In that night's insanity, various brits and crits were square dancing. The caller was a phobedon with a fiddle and a sense of rhythm.

But so many large animals swinging their partners were shaking the floor. I awoke to the thunder of a passing herd.

They say that people living near train tracks, on worlds with trains, learn to sleep right through.

The next morning, the damaged trees were partially regenerated, unlike my mangled tube, which, I now noticed, lacked end-caps and o-rings. This device should have assembled itself. It hadn't. On a whim, I kicked it and was instantly rewarded with a large twisted mess instead of a catapult.

If Parson didn't return, I was in deep trouble.

I spent that day and five more searching, dodging herds, and upsetting the wildlife. Only real drapers ignored me.

Albamy was striped with streams; drinking water was plentiful. But fishy creatures with silver bodies and piranha attitudes were also plentiful. Bathing was out. Despite bacteria-resistant skin, I was developing a certain . . . ambience. I poured water over my body, scrubbed, and still felt grubby afterwards. And soapy.

The campsite-nodules were growing, but slowly.

The seventh day wasn't restful.

I was in a refuge, sheltering from a stampede (even drapers avoided stampedes). The final row of Bright's rambs held an impostor: a scalene ramb. I'd seen pictures of a "scaly" on the *Centipede*; the relatively small sleek form was unmistakable.

I was wondering why a scalene had joined a Bright's herd, when two sidehunters appeared from nowhere, clearly targeting the scaly.

Thrilling! And baffling. Sidehunters were allegedly solitary hunters with incredible appetites, only physically capable of preying on Jopper's rambs. A bony scalene was a stingy meal for two hungry sidehunters.

Beneath my disguise, I rubbed my chin thoughtfully. Parson had called the native animals "flexible."

I was starting to agree.

According to station reports (and Gaines), sidehunters have gigantic appetites. They've evolved a unique method of bringing down prey much larger than themselves.

They resemble seriously overgrown armadillos and have two little holes in their armor, one on each side of their streamlined torsos. Their serrated teeth are comically large.

Inside the torso-holes are organic harpoons, permanently attached by long umbilici. These darts contain a paralyzing fluid and are fired via a gas-filled bladder connected to a secondary stomach.

The system has limitations.

Imagine a sidehunter spearing a massive ramb. The predator, only capable of sprints, is soon dragged along helplessly with possible fatal consequences.

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Therefore, a hunter dashes up between *two* rambs toward the back of a herd. Both darts are fired together, one into each beast. The umbilici retract somewhat and the hunter is lifted and carried along by the dual attachment.

Another problem arises: if the poisoned rambs collapse midjump, the umbilici may snap and the hunter bleed to death. Likewise if one ramb falls before the other.

Dosage is key.

Since each harpoon delivers a specific quantity of venom, the sidehunter needs prey with a specific mass. Rambs must be slowed to a walk before they drop.

Bobby Gaines believed that only the Jopper's ramb has the proper mass.

Sidehunters wolf their food. When the herd turns, anything in their path becomes flat meat.

There they were, ten meters away—two animals I'd come seventy-five light-years to rescue. And I wasn't prepared. I'd been stupidly waiting for proof of living sidehunters. The only useful thing I could do was kick myself.

But the instant the herd departed, so did I.

At home, I grabbed my backpack and tore free its metal buckles. My shark teeth have their good points.

I found an empty balloon, eased the buckles inside, and dribbled in water plus a catalyst: food paste from a green-labeled tube. Twenty drops of a very special depilatory went in last. After resealing the balloon, I shook it thoroughly. The assembling process would take hours, but I watched for awhile anyway, trying to see something interesting through the murk.

Finally I set the thing aside, and resumed thinking about my favorite topic: ways of reaching the station if Parson never showed. As usual, I could only come up with one idea, and that one was certifiably insane. Then I had a new thought: What if I returned, and the stationers locked me out?

I didn't sleep that night.

The next morning, on a hunch, I forced down double rations.

My primed balloon was lying in shreds atop a greasy stain. Among the shreds were ten thin darts with needle tips, fluid-filled bodies, and precise "feathers." The needles were shape-memory-alloy, the soft bodies and feathers came from the memory-plastic of the balloon itself, and the fluid was water-diluted depilatory.

My tongue hadn't been cored only to provide a hiding place. . . .

The depilatory, which might even remove hair, was paramount. Bobby Gaines had spent himself in making it possible. His samples had contained traces of sidehunter venom, skin, and saliva. From these, biologists had produced a neurotoxin intended to put sidehunters into long-term suspended animation.

If, by some miracle, I hit a hunter with a dart, the flexible body would compress, forcing neurotoxin through the tip. Two drops should be enough . . . if the drug worked.

A risky experiment—sidehunters weren't defenseless.

I made a pocket from a bubble-fold and stored away all ten darts.

Rehearsal time.

Mimicking a scaly ramb was easier than imitating a draper. In only two hours, I was ready for the curtain to rise.

But I needed the proper audience. So I waited, sipped water, and listened. For once, it seemed to take forever for the shaking to start.

Midrumble, I went outside to watch a thundering herd of Bright's rambs. When the last row passed, I sprang and managed to catch up. Quite a challenge, keeping pace with a herd while maintaining my scalene disguise!

Soon, I was panting too heavily for self-congratulations. And vision through the bubble was imperfect; periodically,

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I'd nearly slip on something unfortunate. I'd never imagined a career as sidehunter bait, but life is filled with opportunities.

My plan worked almost too well.

After three kilometers, I was wishing the race had a finish line. Then it happened. I suddenly understood how sidehunters had adapted to their . . . nutritional predicament when I spotted one on either side of me.

By finding a properly sized victim, *each* hunter could fire a harpoon; their combined mass would suffice to control their prey.

Surviving hunters must have been jungle geniuses to invent this new technique, but at the moment I wasn't tempted to pat them on the back.

I slowed, shifted to running upright (stretching my disguise accordingly), and pushed enough bubble aside to free my face and an arm. I hastily loaded my tongue with a dart. Now, it was harder to breathe, which wasn't my worst problem. My tongue only held one dart at a time but my attackers had their own missiles. While I was dealing with one crit, the other could fire.

I was still untangling this dilemma when the hunters shot together. If I'd been a ramb, that would have been that. Luckily, I was smaller; the harpoons merely tore holes in my disguise, remaining stuck in the tough tissue.

I used my built-in blowgun on the hunter to my right and loaded another dart.

Predator one collapsed, its harpoon and cord pulling free. That wouldn't do. I got smart and grabbed predator two's umbilicus.

This beast couldn't escape; I shot it, holding fast until it slowed and collapsed. As I released the umbilicus, it retracted automatically.

For a glorious second as I puffed and huffed, I felt a sense of achievement. Then a fist-sized spider flew by, humming, reminding me where I was. I donned my draper costume and hauled my specimen back to where the first had fallen. It was going to ruin my year if something ate predator one before I could grab it.

All was well. After chasing away some ratlike crits who were contemplating drugged sidehunter for lunch, I began dragging my two heavy burdens down the long, long corridor. I used bubble-extensions as ropes and kept on all fours. I was terrified that another herd would come through before I could get my charges to a refuge. So I pushed myself.

I'd expanded my draper imitation enough to keep both beasts covered, which made the illusion . . . wear thin.

When my dome finally appeared, I forgot about aching arms and exhausted legs. The last hundred meters felt easy.

After caging my charges, I threw myself a party.

I ate three containers of food (white-labeled tube-paste tasted almost harmless) and sang dirty ballads accompanied by tongue-whistles. The occasional rude noise or bad note only enhanced the festivities.

The next day was an exhilarating anticlimax, and held a major revelation.

By the time evening fell, I'd captured *six* additional hunters! I hate to brag, but sidehunters simply couldn't resist my performance. Now eight animals were dormant in their very crowded cage. That was the anticlimax: my specimen-gathering tasks were more than complete.

But I'd learned something crucial.

I was dragging back the day's second pair when I stumbled upon another duo feeding. I fired a dart while throwing a second one by hand at the other quarry. It hadn't occurred to me that the damn things could simply be hurled!

Two hits. I was elated until I studied the leftovers: clearly, a Jopper's ramb, perhaps the *last*.

This idea was so upsetting, my costume fell apart. I fought it into shape,

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wondering how these sidehunters had brought down such a large, solitary animal. Maybe it hadn't been running . . .

The wind shifted, bringing a familiar stench: burnt lemon. From the ramb! More precisely (my nose knows) the ramb's *blood* carried the smell. Its other tissues had a gamier aroma.

Somebody must have discovered that Jopper's blood was useful. So useful, Parson had established a secret cell-cloning facility. The station and the stationers I'd met had reeked of—

I snapped my fingers; *they* couldn't smell it! Maybe no ordinary human could.

This didn't explain why the Jopper's species had vanished, but I had a terrible suspicion . . . and an icy foreboding.

But while dragging back four hunters simultaneously—a Herculean task!—I had one encouraging thought. If Gaines hadn't provided samples of Jopper's blood, perhaps I could.

My hunters were metabolically frozen; their stomach-contents would remain somewhat undigested. If I could get my specimens to Mars, scientists could figure out what made burnt-lemon blood so special.

The day Parson was due, I woke early, ate breakfast, and prepared to leave. I wasted some apple juice calling *Centipede*. Were any vehicles moving my way? They couldn't tell.

When the sun finally sank, my heart kept it company.

Finally, I had to face reality.

Lying on my mimetic hammock, staring at the moonlight-dappled ceiling, I retrieved the lunatic concept I'd had for returning on my own.

The idea was bonkers; but, aside from climbing a tree, I couldn't imagine another way to get high enough. Those toothy vines—would my draper disguise frighten a *vine?* I decided to forego the pleasures of arboreal exploration.

It was cooler this evening. With my enhanced vision, I could identify the right spot. Maybe. And it wasn't raining; what better time to try?

I told a horrified Fred Becker my plans, ate, drank, and put the remaining two darts in a bubble-pocket, my map in another. Soon, I was loping westward, the fastest draper ever. I had a long way to go.

"Freddy was right," I admitted to myself, "I must be crazy!" At least I didn't hear a reply.

Sunrise was stirring before I saw wisps of telltale heat wafting from below. No visible creatures were around, not even drapers (a bad sign). I stopped—a misstep here could prove fatal—and studied the rising infrared patterns.

Soon, I'd spotted several trap doors. With sincere delicacy, I tiptoed between well-disguised plates.

Finally I stood on my choice: a long rectangle. I looked up. Perfect! The canopy wasn't quite so tight. There were holes I'd fit through easily—if I could reach them.

I prepared myself, said a prayer to whatever God might be awake this early, and then stomped.

The trap door was hurled open with unthinkable power. I was suddenly fifteen meters in the air! I spread my mimetic wings, extending them and wrapping their fronts around my extended arms. My shoulders snapped into their locked position. I'd become a living glider.

But what was needed at the moment, more than anything in the Universe, was *lift*. I was already losing altitude.

I opened the bubble-pocket in my left wing and let my last darts fall downwards randomly.

Two more doors were flung open, starting a chain reaction, each monster probably wondering what its neighbors were having for breakfast. Soon, so much trapped heat was rising that I had an excellent thermal to work with. I banked around, my wings filling with infinitely precious hot air.

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Gliding: that's why I'd been given infrared vision and hollow bones. I was immensely thankful as I used the heat to climb, finally sailing through an opening high in the foliage.

This hole was an unqualified blessing. It channeled rising air like a funnel, allowing me to turn in mounting spirals in the cloudless sky, laughing beneath a fading moon.

As if to celebrate the moment, a host of fireworks-plants released spores. Shooting colors challenged the rising sun's glory for a few startling moments.

The scene beneath was a protean ocean of leafy chaos. Sunrise edged the struggling foliage in beneficial fire, generating new thermals well within gliding range.

I pointed my feet toward the alien dawn and flew westward.

At first the flight was delightful. Jungle living had felt like living underwater. Now, the blue sky's uncompromising brightness was intoxicating.

Looking down, I could frequently see to the forest floor where apparently tiny crits were sadly reentering their lairs.

Here, on the periphery of the great herds' stomping grounds, the monsters supposedly avoided herds. What, I wondered uneasily, was *feeding* so many beasts? Which crits were brainless enough to stroll through the Trap-Door Jungle?

Gliding has its own music. The air makes a pleasant swish as your wings cut through; when a crosswind appears, the sound intensifies. Sometimes your wings flutter. I kept gliding from thermal to thermal, rising just enough to reach the next. With the favorable wind, I hoped to reach the station before dark.

I blessed the lack of aerial predators.

From above, the forest had distinguishing features; restless branches didn't obscure overall patterns. Changes in terrain and color-splashes from non-conformist trees made identifiable landmarks . . .

Uh-oh.

Parson had avoided flying me here because I could have arranged a distinctive, pre-prepared landing spot. He didn't know the *Centipede*'s shuttles were useless.

Randomly deposited in Albamy, I would have been virtually unfindable . . . without a radar-reflecting dome and home-baked T-comm.

Of course, Parson hadn't *wanted* me here; that's why he'd showcased the station-area insanity. I hadn't crumbled, so he'd probably selected the most intimidating route to the jungle.

When I persisted, he finally dropped me at a lovely campsite, scheduled for demolition by whatever nightmare lived in those innocent-looking shells. Not that he'd expected I'd survive even that long.

In short, he'd wanted me off the job or dead; the burnt-lemon secret was that important to him.

Would the stationers invite me inside if I knocked politely? More likely they'd start shooting. And locking me out would be child's play . . .

What was I going to do? Chew through an acid-coated dome?

And where should I land? In the compound, I'd be exposed to fire from plasma-cannons, plasma-coils, blue-lasers, etc.

But landing outside, I'd have to cross that wide and deadly moat—before scaling an electrified fence topped with spikes and flames. And *then* I'd be facing weapons, locked doors, and murderous stationers.

Susan, I told myself, you'd better think of something exceptionally cute this time.

So I did. But it wasn't going to be fun.

My plan required landing outside the compound, which involved desperate moments searching for a clear spot. I settled for (and in) a tree striding purposefully in the right direction. I jumped

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down only twelve meters from the moat.

In draper disguise, I gazed through the fence, hoping this would be the right place.

It wasn't; the domes weren't lined up properly. This meant forcing my way along the perimeter through twenty meters of bloodthirsty frenzy.

At first, getting crushed seemed the chief danger. Then I attracted an admirer: a six-legged crit—unafraid of drapers!—with scythelike front legs. My charmer had two massive cutting surfaces in lieu of teeth. With built-in cutlery, who needs teeth?

A decapus in a tree rescued me by snatching my pursuer off the ground. It bit the animal in half, holding the remainder upright and level while it chewed, probably to avoid unnecessary spillage.

Finally, I stood opposite the dome containing the AATVs. Two weeks earlier, in happier times, I'd stood on the other side looking out.

Genuine drapers were near, essential to my plan. This instant, nothing was threatening me.

Time for a quick mud bath.

A small stagnant pool was close. Using handfuls of stinking muck from the bottom, I coated my chest and arms (so much for smelling like stale laundry) while considering the moat.

The damn thing was too wide to jump; even the fumes were deadly, and creatures kept away. After running full-tilt, I could probably glide over . . . and wind up on the fence, electrocuted.

The fence looked sturdy and had to be acid-resistant to boot. This left the one ugly option I'd dreamed up.

I applied more goo to my hands and arms and then—mentally apologizing to the innocent brit—lifted the smallest nearby draper and ran toward the moat. The creature wasn't heavy, but I can't sprint my fastest while upright and my skin protection already bubbled from concentrated alkali.

I soon felt like I had an armful of acrid smelling molten lava, but I kept moving.

Eyes tearing, I approached the moat and hurled the draper across and into the fence. Sparks showered, white smoke erupted, and a scourge of white bubbles slowly ate a hole in the barrier. When it had expanded enough, my unwilling ally fell through, thoroughly dead.

By now my hands hurt so much, I took a desperate chance. I closed my eyes, held my breath, and moved forward to stick my arms directly into the acid for a splitsecond. Lucky my eyes were closed! The hissing and popping war of chemicals spattered my face. I jumped backwards, returned to the puddle with earnest haste, and tried to rinse everything off.

Trouble was, I had no time. The damage would be triggering alarms and Parson could guess who was responsible.

I slapped on more mud, made sure the way was clear, then ran on all fours toward the moat. At its edge, I jumped, spread wings and glided; at the last moment, I furled my wings. Momentum carried me through the hole.

Now for the worst part. Could I do it?

Hoisting the draper again, muffling my involuntary scream, I ran toward the shiny muzzles outlining the airlock. I tried not to wonder what being incinerated feels like.

No plasma emerged, but my hands and arms were on fire anyway.

I'll *never* know how I managed to fling the draper high enough. But the body landed atop the nearest dome and slid lazily downwards, almost to my feet.

The results were spectacular! Giant bubbles covered the air lock, the dome, and were spreading.

Plasma-coils with blocked apertures won't energize—a safety feature. And bubbles would foil exterior optical scanners. For now, I had a degree of both safety and privacy.

I leaped the furiously boiling corpse, stood on fused sand before the lock, and

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tried to recall Parson's inflection.

"Bunny," I whispered and the door to the kingdom opened.

Yes, I could have glided to this spot, said "Bunny," and gotten in without half killing myself. But I didn't feel foolish. If Parson had taken the elementary precaution of changing the code and I *hadn't* painted the station with draper juice, I could have wound up in a hopeless position.

My plan, if I'd been locked out, had been to lift the poor brit one last time, rub it directly on a wall, and see which would yield first: the wall or my cutting blades.

In my business, you minimize risks and live with consequences.

Trying to ignore my hands, I entered the lock—another tense moment. I used my tongue to punch the remembered keypad sequence. The outer door closed, the inner one opened, and I stepped warily into the room. Nobody home.

These stationers, I thought, might be brilliant biologists, but they needed a remedial course in tactics.

For a while now, an annoying whimpering sound had been troubling me. I clamped my mouth shut; the sound stopped . . .

With my teeth, I quickly pulled aside three tarps and there they were: three AATVs! Probably the station's entire inventory. How could Parson be so foolish? Using his obnoxious voice again, I said "Safe" and the nearest machine opened.

Even before the roof had automatically closed, I was crammed inside the bathroom, rinsing my wounds with clean water.

Agony.

My injuries were serious. What little skin remained on my hands was either dead white or ominous with blisters; blood and lymphatic fluid were oozing. Hide on my forearms was more intact, but tended to hang off in ragged fringes. Underlying muscles looked burned. I was panting like a dog.

A small sink-mirror showed a face I hardly recognized. Aside from waxiness, it was suffering from a plague of boils: blisters from the spattering at the moat. The leonine eyes were feral. . . .

The bathroom had a medical kit. Using my mouth, I grabbed a tube of burn-ointment, bit it open, and used my hollow tongue as a straw, sucking in petroleum-tasting ointment. I extended my tongue, gently spraying lotion on my hands and arms. Another disgusting dip bought me enough goo to coat a bubble-section, which I rubbed over my face.

Far too slowly, the fire subsided to merely excruciating. My breathing calmed. I could function now, but could only gaze longingly at gauze and bandages. . . .

Incredibly, I spotted a tiny smile hiding beneath mutilation, pain, and smeary ointment. What was there to smirk about?

The answer erased the smile. So far, this had been absurdly easy and I knew why. Sure, Parson was unaware of my . . . unnatural endowments, but he'd underestimated me for another reason: my speech impediment. Many people assume a person with slurred speech is dim-witted. . . .

And I *was* dim-witted, gazing endlessly at my reflection like some overage adolescent! It was past time to get moving!

Blessed be thy virtual controls, for they do not require physical pressure!

I'd watched Parson operate this vehicle. The hardest part was curling my hands enough to insert them into the glowing modules.

After that memorable task, I backed the AATV up and practiced using the plasma-cannon. The other vehicles melted beautifully. Even fulleron can only take so much.

I drove to the double-door, angling my machine to touch the pressure-plate. The door stayed closed; could someone

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have finally noticed things were amiss?

I shook my head, sadly, before blasting the wall and rolling through. Down the hallway, four armored guards were aiming blue-laser rifles.

They began shooting.

Didn't these idiots know about fulleron? Light was already bouncing off my chariot in increasingly coherent patterns.

Soon, my attackers would be amputating their own limbs . . . at best. I considered putting the quartet out of my misery, but decided I was just cranky from pain. I fired a trivial plasma pulse, aimed high.

Throbbing turquoise faded. The guards hooded their eyes, contemplated the red-hot ceiling, and decided to vacate. Some dropped their weapons to vacate faster. I followed leisurely.

Coming to the four-way intersection, I went straight, stopping before an extra-wide doorway. No guard today.

Even with the AATV's superb air-scrubbers, I smelled burnt-lemon.

Unsurprisingly, the pressure-plate didn't work. But before I could make my own entrance, the door opened. My vehicle barely fit. I stopped halfway through, barricading the opening.

Inside was a typical lab: shiny surfaces, test tubes, ultracentrifuges, virtual-microscopes . . . and two women wearing typically white lab-coats and atypically anxious expressions. Parson was also there, wearing his command belt.

"Can ye hear me, Professor?" he shouted.

"Easily."

"What'd ye say?"

I raised my voice, "You needn't shout, Stationmaster, I'm right here." I was in foul humor, mocking him with his past words. "Now that my . . . elocution is repaired, sir, you should have no trouble understanding me."

"Well—ye seem to have us at a disadvantage. What . . . occurs now?"

"We'll have a chat; but first, I need to use your dataserver." A workstation lurked in one corner.

"No! Ilisa be private station property and I don't see—"

"Parson," I roared, "we are *long* past that point! I know about the rambs and the drug." More bluff than lie, really.

"Sweet Jesus!" he groaned, lapsing into a sort of festering silence. Then, "Listen, Artab, mayhap I hold an interesting offer. Can we bespeak face to face?"

"Why not? Remove your belt and gloves, put them on the floor. Nicely done! Now, kindly stand back."

The tiniest plasma pulse slagged the weapons. I advanced the AATV just enough so that its roof could open, and climbed out carefully. Burnt-lemon stench almost knocked me over.

I'd restructured my bubble into clothing, but I'd forgotten how I looked (and smelled).

The stationers gasped, backing away. "Mother Mary!" Parson cried. "What *happened* to ye?"

"Nothing good. Sit on the floor, all of you, and stay put. I'll be with you shortly."

"And what occurs . . . should we refuse?" the stationmaster asked slowly, eyeing my wounds.

"That problem shouldn't arise." I unfolded one foot and sliced a sturdy wooden stool neatly in half.

My audience, two shades paler, followed instructions.

I sat in a wide chair facing the dataserver he'd called "Ilisa": a recent-model IWBM with a virtual screen and no keyboard. I whipped my head around and caught a fugitive slyness on Parson's face.

I grinned, showing all three rows of teeth. "It's voice-controlled, but only by authorized voices?"

He stared back challengingly.

"No problem." I cleared my throat. "Ilisa, do you ken who I be?" I said in Parson's voice. The stationmaster's eyes

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gaped in horrified astonishment.

"Ye be Stationmaster Gregory Parson," replied a pleasant contralto.

"No!" Parson cried out.

"I mean aye!" I corrected enthusiastically. Those horrid AATV days were paying off. "Keep your mouth *shut*, Doctor," I growled in my own voice. "Ilisa, who holds the station's highest security status?"

"Ye do, Stationmaster."

"Be it legal for me to reassign this status?" Dual grunts revealed that Parson and one of the women knew where I was heading.

"The word 'legal' be ambiguous in this context."

"Hmmm. Be it . . . allowable?"

"Such a reassignment be proper if ye wish it, Stationmaster."

"Excellent! When I stop talking, you will only respond to and obey the next voice you hear: that of Professor Artab. Be that clear?"

"Aye, Stationmaster." I heard Parson inhale sharply but my glare discouraged any stray remarks.

It was that easy. I spoke normally and became the stationmaster.

I immediately ordered every doorway and internal partition shut and locked until I said otherwise. Stationers would remain wherever they happened to be.

An electronic check on Parson's shuttles produced no surprises. *Both* shuttles were operational and fueled. I accessed the communications system and reported to *Centipede*, telling a very relieved Fred Becker that I'd commandeer a shuttle and pilot after resolving some final issues.

The next step was to scrutinize station records through the dataserver's myopic eye. I got to work.

Names and faces appeared from the settlement's early history: Will Jopper; Arnie Bright; Enoch Parson's wife, Barbara, whose nickname, I read, had been "Bunny." I encountered redheaded Carl Rambis, who'd discovered the herds. . . .

Name after name, face after face, appeared—mostly people I'd never heard of and largely filed under "deceased."

The founder showed up, of course, but I wasn't interested in old Enoch; surely, the hint I was seeking would be more recent. I did note his family resemblance to Greg.

But one early settler grabbed my attention: Ian McDougal, an animal-behavior specialist with extremely close-set blue eyes.

I swiveled the image forty-five degrees. My absent neck-hairs tried to rise.

Three minutes with a holograph-editing program and this mug could become George Friskel's. Or visa versa. Or maybe the record was honest, but a morphic-surgeon had gotten rich.

In either case, I was dealing with something extraordinary. If Friskel was McDougal, he was over two hundred years old! Even with telomere therapy, no one was living *that* long, and no one past the century mark looked thirty.

He'd said he liked animals. He'd given me—damn. He'd tried to help me. He'd given me a map!

Friskel had alerted the Council about the sidehunters! And Parson suspected. On our journey, he'd asked about the contents of my pack to see if George had slipped me anything useful. Which suggested there *was* a verifier on this world: hidden on the AATV!

I retrieved Enoch Parson's stern face.

"Machine," I said. "Expand screen 50 percent. On half, show me Enoch Parson's left eye, magnified ten times." I ignored an unhappy hiss from nearby. "On the other half, show Greg Parson's left eye, similarly magnified."

Yes. Enoch and Greg had different faces, but identical eyes, down to minuscule color variations.

Impossible. Due to nutritional and other small deviations, even monozygotic twins have disparities in fingerprints and iris-patterns. Even *clones* develop unique irises!

Someone should have retouched Enoch's eyes. Disregarding the absurd

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possibility that Greg had transplanted his grandfather's orbs into his own head, Greg was another bicentigenarian . . . or whatever the hell you call people who've lived that long.

I called up records for Greg's father, Daron. Slightly different face, same eyes.

Burnt-lemon reek was forcing the obvious explanation down my throat. I was choking on ugly implications.

I swiveled around. "Ladies and gentleman, let's see if I've got the story straight."

Silence.

"This planet is a biological gold mine. That's why you're here. For years, Parson was king of pharmaceutical mountain, raking in money fast as anyone could print it. Then, one sweet day, you struck the mother lode. Someone—Will Jopper?—discovered the ultimate rejuvenator. Something in Jopper's ramb blood.

"But success attracts economic predators. Despite your foresight in building the station in a spot guaranteed to discourage uninvited visitors, competitors were managing to duplicate your drugs, killing profits. You didn't want that happening with the geriatric product.

"It wasn't just the money. That product was your chance for *power*. You decided to keep it secret.

"But anyone who acquired a Jopper's ramb could eventually produce the same medicine. If word leaked and some enterprising industrial or government spy bribed a station employee to reveal the drug's animal source. . . . It wouldn't be the first time armored thugs with Ph.D.'s raided a frontier planet.

"Incidentally, the Xenozoo already has Jopper's tissue specimens."

That got an interesting nonresponse. Apparently, they knew but didn't care. Maybe Bobby Gaines hadn't taken blood samples after all . . .

"I've also gathered *fresh* samples." Suddenly, Parson was overdoing his poker face. "Returning to our sordid tale: You sat on the drug, set up a cell-cloning lab, and for years used the rejuvenator strictly on yourselves. How am I doing so far?"

From the murderous looks, I was on track.

"You planned to peddle the stuff, sure; but first you had to ensure your exclusive. So you decided on a . . . radical approach. Maybe abhorrent would be a better word, or stupid, or desperate."

I couldn't help sounding angry.

"The Jopper's, according to old station reports, was once profuse; must have taken many decades to exterminate them. Decades, never knowing if some unauthorized collector might get lucky, before you dared offer the drug to anyone outside your inner circle.

"And since Ecomission inspections were still happening then, you had to be . . . devious. Luckily, you had plenty of time. God knows, you had time."

"So *what?*" Parson exploded. "What harm have we done? My world be crawling with crits. So what if one kind stops crawling?"

I stared in disbelief. "Have you forgotten what happened on Earth? Don't you remember 'global browning'?"

"Remember? I'd been living here five decades when that browning nonsense occurred."

Now I stared harder, in a sense staring at history. Parson, like everyone, was a product of his times. When he'd been growing up, the idea of ecology had become almost a joke, like some silly fad people had outgrown.

Fifty years ago on Earth, no one was laughing. The planet's primary source of fresh oxygen, oceanic phytoplankton, had thinned dangerously. Farming productivity kept dropping due to the troublesome combination of global pollution and a diminished oxygen supply. Plants require carbon dioxide for photosynthesis, but they also need oxygen for the respiration part of their cycle. Eventually, scientists saved the day by retroevolving and releasing vast clouds of

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cyanobacteria: primeval anaerobic organisms that originally gave Earth's atmosphere the gift of oxygen.

The crisis passed, but not without terrible suffering. Humanity learned its lesson. Most of humanity.

"Doctor Parson," I said quietly. "I'll tell you something you should know. It's absurdly simple. All life on your planet is interdependent."

"Rambshit! The Jopper's be almost gone now and ye can't describe one bit o' difference it's made."

"Wrong. I'll give you *two* examples of major changes already underway. I don't know how you killed so many Jopper's, but I know where the evidence went."

"Where?"

"Down the gullets of trap-door monsters. The immense food supply generated hordes of new citizens. What's going to happen as they starve?"

Parson had been leaning forward aggressively, but now he shrank back.

"They'll eat each other," he offered weakly.

"I doubt it. But there's more. I was in the jungle for two weeks and I only saw one scaly ramb. *One*. Scalenes used to be common, right? But all the Jopper's predators have had to switch brands. The scalene supply is running out . . .

"These things have consequences, Doctor. I have reason to know. You've started an avalanche, and so far, all you've heard is the first pebble shifting."

The stationmaster raised his head; some of the fight was back. "So? We'll simply leave this world if we must."

"Shortsighted callousness nearly ruined the Earth, but your idiocy is on a grander scale. Once, the Atlantic Ocean seemed too big to pollute. But even a *galaxy* isn't too big to pollute!"

"Bah! There be more stars than—"

"We can't live on *stars*, sir. How many truly habitable planets do you think this galaxy holds? The human species is delicate, Doctor; we need a very specific environment. It may take centuries, but eventually, if everyone treats their worlds the way—"

"Ye claim *this* world be habitable?"

"I'm still alive, aren't I?"

"I can't imagine why. But how many crits did ye butcher to endure?"

"In Albamy, I killed exactly two animals. They were about to pounce on you, if you'll recall. Surviving the jungle wasn't difficult—with some protective coloration."

"Then—"

"No time for more debate. But there's one thing I'm curious about."

Parson's hands clenched. "Why I haven't had my missing fingers regenerated."

"No, I figured *that* out. The drug makes you heal so quickly, scar tissue blocks true regeneration. You can't debride fast enough."

"Well . . . yes, but—"

"My question is: what happened to your wife, Barbara?"

That shook him. "Dart-snake," he whispered. For the first time, I felt some connection to this man. He'd chosen her nickname as his password . . .

I returned to the dataserver. "Ilisa? How many people are in the station right now?"

"Eighteen, Professor Artab."

"Good news, Parson," I turned in my seat. "I have another question after all. Where did everybody go?"

"I will say because I choose to." A return of habitual arrogance hardened his face. "For years we've had no need o' crowds; this one lab supplies us with funds and to spare. We've . . . let the understaff go. You see, I've given a lecture or two among the stars, and made friends along the way."

"Important, influential friends? *Young*-looking friends, by chance?"

"Perhaps they be getting that way. Meanwhile, most o' our people have returned t' the Interworlds. Gone back rich . . ."

"You're offering me a bribe."

"Long life, and staying *young* while ye

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live it! Financial luxury. And a chance to shape the future."

"Sounds like quite a bribe. How would I earn it?"

"Keep our secrets secret, then go or stay as ye please."

"Then here's my counteroffer: sufficient private time for your advanced ecological studies. Jail, and plenty of it."

Parson looked nervous, but also like he had something up a sleeve. "Ye be choosing to act the fool, Professor."

"Know why people like me were officially named hybridim, Parson, not just . . . hybrids?"

"Does it matter?"

"To show respect. The word refers to cherubim and seraphim. High-class angels. We've made *sacrifices* to become what we are, trained harder than you'd believe; and they keep altering our bodies, which means more pain and training. And it looks like we'll never get to be human again."

"So why—"

"It takes commitment to accept this life. And discipline. Who would go through so much hell without truly believing it was necessary?"

Parson sat straighter, eager to play that hidden card.

"Alas, Professor, your noble sacrifices don't signify. The Ecomission carries weight with the Interworld Council, certainly. But we've been . . . distributing our medicines with care. Truthfully, I carry some of your precious Ecomissioners right in this pocket. I guarantee, your report will wind up permanently drawered."

"How forthcoming of you! I only *assumed* you'd corrupted Ecomission administrators." No wonder he hadn't worried about the older ramb samples. "But I may have misled you . . . inadvertently. I don't work for the Ecomission. Not directly. My team has a few more teeth." I manufactured another sharky grin.

"The Ecoservice?"

"Absolutely."

"Christ! That be misfortunate. But mayhap your Ecoservice bosses be less blind than yourself to longevity's worth."

"My particular boss seems worried about that, too; I gather he sent me here without informing his peers or superiors. But I shouldn't have any trouble . . . sniffing out corruption at home." Such as Ecomissioners reeking of burnt-lemon.

"Frankly, between your wholesale slaughter operation and your political, uh, *chicanery*, you might be in for some legal trouble."

Parson's suddenly looked his age. "Ye be one of Colonel Bluff's men? Hell, I've been warned about him."

"I work for Charlie. But you keep making one mistake. Tell you what: I'll tutor you after I finish my business in the jungle. You won't mind if I change the entrance code on the AATV before I leave?"

We're halfway to Mars now. I'll be savoring the disinfectant smell here in sickbay for another week, but I'm *breathing*. Right now, that's enough.

My nurses, bless them, claim I whimper in my sleep and advise me to demand stronger painkillers, but I know better. It's those dreams. . . .

I haven't shared everything I experienced on Parson's Planet and never will. No sense in giving others such nightmares.

But when I awaken in the dark, shivering, I can cheer myself by remembering my final encounter with Greg Parson.

The station had a gamma-class shuttle, big enough to carry twenty sidehunters. After a merry round of analgesics, I had George Friskel fly me out to my jungle camp. With his help, and by using my bubble as arms, which made his eyes bug, we managed to get all eight sleeping beauties inside.

For once, nothing went wrong.

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Back at the station, I handed over partial control of its doors and partitions to Parson. I didn't want stationers starving before Ecoservice police ships could offer them a lift to the nearest Interworld courtroom. But I couldn't have Parson locking anyone out or gaining access to firepower.

After organizing a collection of portable weapons and destroying them, I re-entered the lab and made some final arrangements via the dataserver. Of course, Parson and his companions were there. No one seemed pleased to see me again.

"I'm leaving now," I said sweetly. "But there's something I wanted you to know first, Doctor."

"What might that be?" he asked sourly.

"My name. I'm Special Agent Susan Diane Artab. Sure, I'm one big muscular daughter-of-a-bitch, but next time you examine someone's scan, take my advice: check for ovaries.

"So don't think of me as one of Charlie Bluff's 'men.' No, sir. Think of me as a *lady*."

You should have seen his face.■

IN TIMES TO COME

The cover story (with art by Vincent Di Fate) for our July/August double issue is "Unseen Demons," by Adam-Troy Castro, who has heretofore appeared in *Analog* only a couple of times, but each time to unusual reader acclaim. "Unseen Demons" means just what it says, but that's not giving too much away—you'll still be thinking about *exactly* what that means well after you've read it. The story concerns a crime—or is it?—against members of one of the most alien species you'll ever meet. And that fact raises all kinds of questions about what makes a crime a crime, and what makes people (or other beings) do what they do. . . .

Dr. Steven D. Howe's science fact article takes a new look at a question that people recently have tended to avoid thinking about, perhaps in the hope that it will go away: How much space exploration can we do without using nuclear rockets? Aversion to anything new and nuclear has become a widespread reflexive reaction, but Dr. Howe makes a good case that nuclear rockets can do the job far better than anything else we have available, and that there is really no good reason to shun them.

The rest of the issue will feature a wide variety of stories by such writers as Brenda W. Clough, Rajnar Vajra, Ron Goulart, Jack McDevitt, Larry Niven, and Geoffrey A. Landis—plus a collaboration by Kevin J. Anderson and Gregory Benford. Lloyd Biggle, Jr. offers a special symposium on Isaac Asimov as remembered by several of his colleagues, and we'll present the results of The Analytical Laboratory for 2001—the last word from you, the readers, on the best of what *Analog* published last year.

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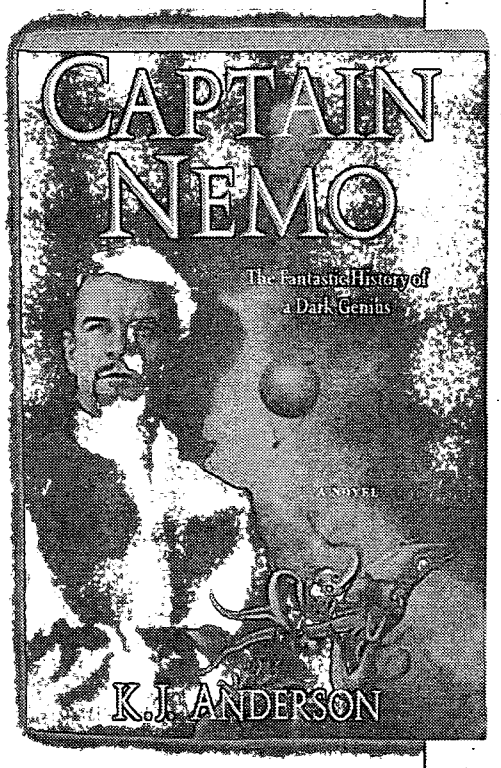
NEW FROM *NEW YORK TIMES* BESTSELLING AUTHOR

K.J. ANDERSON

What if
Captain Nemo
was a real man...

whose actual
life was more
fantastic and
adventurous
than all
the fictions
it inspired?



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FACT ARTICLE

SUBSISTING ON OXYGEN LITE:

Altitude Research, Himalayan Mountaineering, and their Applications to Alien Worlds

Richard A. Lovett, Ph.D.

In 1963, Thomas Hornbein and his climbing partner Willi Unsoeld completed one of the greatest feats in U.S. mountaineering history, ascending Mt. Everest by a never-before-climbed route, crossing the summit, and descending by another route. On the descent, Hornbein banged his oxygen cylinder against a block of ice. Something started to hiss, and Hornbein, realizing he was losing oxygen, reached back to shut off the regulator, planning to save his remaining gas until later. Almost immediately, his vision began to narrow and darkness crept in around the edges—the classic tunnel vision that precedes a faint. Reacting before it was too late, Hornbein turned the gas back on and tracked down and fixed the source of his leak.[1]

Nearly 40 years later, he cites that experience as a turning point in his life, comparable to his first youthful encounters with mountains. Those first alpine visits set him on the path to Everest. Nearly blacking out after he got there made him realize how closely Himalayan climbing pushes the body's physiological limits. That sparked a research interest in the effects of elevation, a passion he now pursues as a professor of physiology and biophysics at the University of Washington.

On first impression, such research might not seem to have a great deal of relevance to science fiction. Few science-fiction readers have anything but an academic interest in climbing, and

[1] Hornbein recounted this story last spring, at a symposium on altitude research at the 2001 annual meeting of the American Association for the Advancement of Science, Feb. 15-20 in San Francisco. The story is also contained in his 1965 mountaineering classic, *Everest: The West Ridge*.

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even fewer stories have attempted serious speculation about otherworldly mountaineering. But high elevations have an honored role in speculative fiction. In Greek mythology, Icarus soared above the earth on wings made of feathers glued together with wax. Overcome with pride and the freedom of flight, he ventured too high, coming so close to the Sun that the heat melted the wax, causing him to plummet to his death, his wings ruined.[2]

The Greeks had no concept of what we now call "science fiction," but the myth of Icarus functions much like a science-fiction story—a cautionary tale of technological hubris and the scientist's resulting demise. When people eventually did begin to fly, in hot air balloons rather than by flapping artificial wings, history even proved that the myth had issued a valid warning, although not for the correct scientific reason. Rather than suffering from solar heat, the early balloonists zoomed too quickly into a realm of reduced oxygen, where some passed out from hypoxia (lack of oxygen) and may even have died. It was an early victory for science fiction, and an indication that it might behoove us to study high-elevation conditions before venturing too far into them.

Understanding how the body functions in reduced atmosphere is also useful for space exploration. Not only is it important to know how long you can survive in a leaky spacecraft, but terraformers and the creators of the domed habitats beloved of old-fashioned stories will also benefit from high-altitude research. Stories often presume that such environments will mimic sea-level earth, but terraforming is likely to be expensive, especially if it uses enormous amounts of energy to liberate oxygen from rusty rocks. Similarly, domed habitats will be cheaper to construct and less prone to catastrophic blowouts if they are pressurized to something less than a full atmosphere of earthly air.[3] The same may apply to orbiting habitats, especially if construction materials must be ferried into space on costly shuttles.

Many space colonists, therefore, are likely to work in conditions similar to high-altitude Earth. The vital question is "how high?" Denver? Mexico City? Tibet? Or something truly extreme, such as Mt. Everest? The answers lie in research being conducted to assist not only climbers, but anyone who lives, works, or plays at high elevation. Other research may lead to gene tests to select the colonists who will most easily adjust to whatever conditions such habitats might entail.

Here on earth, the military might also benefit from such research. Even before the war in Afghanistan, it was all too easy to imagine scenarios in which commandos and terrorists play deadly games of hide-and-seek in the mountains of Central Asia or South America, with outcomes depending on the tradeoff between one side's high-tech equipment and the other's superior altitude acclimatization.

In fact, high-elevation military operations have already been conducted in the long-standing border conflict between India and Pakistan, with troops stationed at elevations as high as 20,000 feet. "I don't think there have ever before been so many people at these extremely high altitudes, not able to get down," says John West, a high-altitude physiologist at the University of California, San Diego. West speculates that the

[2] This is an extremely condensed version of the myth, which also involves Icarus's father, Daedalus. A longer version can be found at www.granavenida.com/superciencia/stsdaed.html.

[3] These principles are already applied in airline cabins, which are maintained at pressures equivalent to at least the altitude of Denver.

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altitude has claimed more victims among these troops than the military clashes themselves. Accurate or not, that speculation underscores the first difficulty of working in low-air-pressure environments: basic survival.

Living, Breathing, and (not) Dying at 20,000 Feet

Mild altitude sickness usually takes the form of headache, nausea, dehydration, or loss of appetite. These can be debilitating—I once hiked up California's 14,500-foot Mt. Whitney (the highest peak in the continental U.S.) with a group that included a woman who later was later unable to remember anything above 13,000 feet. Had she lingered on the mountain, she might have fallen prey to one of the most severe forms of altitude sickness, characterized by potentially deadly fluid buildups in the lungs or brain.[4]

Of these two, the more common and better understood is fluid build-up in the lungs, called high-altitude pulmonary edema (HAPE). It strikes quickly, without much warning, but clears up even more quickly when victims are brought back to lower environments. There are stories of helicopter rescues from the slopes of Denali (the Indian name for Alaska's 20,300-foot Mt. McKinley), in which climbers who appeared to be on death's door were hopping around taking photos by the time the chopper got to the lowlands.

HAPE is rare at elevations below about 14,000 feet but can strike sensitive people at ski resorts as low as 8,000 feet. It can even occur at 5,000 feet in people with congenital lung defects. It is characterized by extreme listlessness, inability to walk or sleep, coughing up bloody sputum, and a "strange" sensation in the chest. The simplest cure is to get the victim down to lower elevations, quickly, but a pressure chamber in a military field hospital or a space colony could be used when this is impossible. Earthside, one could even envision pressure chambers being permanently installed at popular tourist destinations, such as Mt. Everest Base Camp. People who've suffered one episode of HAPE won't necessarily relapse the next time they return to a low-oxygen environment, but they are at higher risk, and may find it necessary to confine themselves to safer realms.[5]

Even though altitude is obviously the cause of HAPE, the mechanism by which it occurs was disputed until the spring of 2001. Then, a group of Swiss researchers announced they had answered this question by snaking catheters into the pulmonary arteries[6] of 30 European climbers—16 of whom had previously experienced HAPE, and 14 of whom had not. The scientists extended the catheters all the way into the capillaries of the volunteers' lungs, where they monitored their blood pressures at low altitude (1,600 feet) and

[4] For a more about altitude sickness, visit the web site of the CIWEC Clinic Travel Medicine Center in Katmandu, Nepal, at ciwec-clinic.com/altitude/alti2.html.

[5] This raises some interesting story premises for low-oxygen space colonies. These societies might evolve class structures that stratify residents according to the conditions in which they can live and work. The people with the greatest freedom of movement wouldn't necessarily be the ruling class. A colony might evolve an inverted structure in which the least pressure-sensitive people are an underclass, like worker bees or robots, who tend to the privileged few who can afford high-pressure homes but can't venture out of them without oxygen masks or pressure suits. The revolt, when it comes, would be simple: the workers would just pull the plug on their overlords' gas, and watch them suffocate.

[6] The pulmonary arteries are the ones leading from the heart to the lungs.

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high altitude (15,000 feet).[7] They found that at high altitude, the HAPE-susceptible individuals had artery and capillary pressures about 40% higher than those of the nonsusceptible climbers, an effect that helped drive fluid into the HAPE victims' lungs.

Knowing the cause facilitates treatment and prevention because capillary pressure can be lowered with a class of anti-high-blood-pressure medications called vasodilators. Mountain climbers are now being advised to carry these drugs in their medical kits, and they are an obvious, lightweight addition to field kits for use in any low-pressure environment.

An even lower-tech solution is acclimatization. This won't prevent all cases of altitude sickness, but it will greatly reduce the risk, particularly at modest elevations. Its biggest drawbacks are that it takes time and begins to reverse itself as soon as you return to sea level. These problems won't be much of a constraint for emigrants to space colonies, but they mean that high-elevation troops will need to spend a great deal of time on mountaintops or confined to reduced-oxygen facilities if they want to be ready for instant deployment. Occasional rotations to sea level won't detrain them too rapidly, however, especially if they spend most of their indoor hours in low-oxygen environments that mimic higher elevations. As we'll discuss below, distance runners have already developed training regimens that do exactly this.

Acclimatization begins the moment you change altitude and continues for several weeks as the body fine-tunes its ability to function in its new environment.

The most important adjustment occurs first. At 20,000 feet, there's about 42% as much air as at sea level, so the body attempts to compensate by moving nearly 2 $^{1}/_{2}$ times as large a volume per minute through the lungs. Your breathing rate accelerates and you may find yourself taking deeper breaths, much as you do when climbing a flight of stairs or starting to run. In fact, the adjustment in breathing may be a spin-off from the mechanism that provides extra oxygen to laboring muscles. The body contains numerous poorly-understood oxygen sensors that help regulate the breathing rate based on the amount of oxygen in the blood. The higher you go, the more dramatically your breathing rate is affected, until you reach the point where Reinhold Messner, the first man to climb Mt. Everest without supplemental oxygen, described himself as "nothing more than a human, breathing lung."[8]

Increased breathing isn't the only way the body adjusts. West once helped lug an exercise bicycle and other equipment to the 24,400-foot level on Mt. Everest to measure the effect of altitude on climbers. He reports that in addition to increased breathing, the following physiological changes also occur:

- There is an increase in the density of capillaries in the muscles.
- The muscles increase their supply of oxygen-using enzymes (presumably to make more efficient use of whatever oxygen is available).
- Hemoglobin (the substance that carries oxygen in the blood cells) increases its affinity for oxygen. This appears to be an indirect result of the heavy breathing that is a normal concomitant of moving to higher elevations. Not only does the increased respiration increase the amount of oxygen passing through the lungs, but it also causes the body to exhale a greater fraction of the blood's car-

[7] Marco Maggiorini, et al, *Circulation: Journal of the American Heart Association*, April 24, 2001.

[8] As quoted by Hornbein at the 2001 AAAS meeting.

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bon dioxide. Because dissolved carbon dioxide is an acid, getting rid of it drops the acidity of the blood below normal—and, in a remarkable feedback mechanism, this increases the hemoglobin's affinity for oxygen.

Not all of the body's attempts to acclimate produce unmitigated benefits. It's well known, for example, that the body responds to elevation by making new red blood cells. This appears to be derived from a feedback mechanism designed to cure low blood oxygen levels caused by malnutrition, anemia, or blood loss. That's an appropriate response to these conditions, but as a reaction to high-altitude hypoxia it's a decidedly mixed benefit. The extra cells carry more oxygen, but they make the blood thicker, impeding its ability to get that oxygen into the tiny capillaries where the oxygen is needed. Researchers in the Andes have tested the effect of artificially undoing this adaptation by withdrawing moderate amounts of blood from people with the highest red cell concentrations. These people's blood volumes quickly rebound to normal, but during the weeks it takes them to replenish the lost red cells, their blood is slightly thinner than before. In the interim, some of the test subjects could actually do more exercise than they could with their normal complement of red cells.

Another maladaption produces a sleep disturbance called "periodic breathing," which appears to be the result of oxygen-regulating mechanisms falling into a mode of recurring overshoot/undershoot. Sufferers from this condition breathe in surges—several deep breaths followed by 10 to 15 seconds of apnea (cessation of breathing). "It's rather alarming if you're sharing a tent with somebody who's doing periodic breathing," says West. "You hear these great big breaths, and then your companion stops breathing altogether. You wait and wait and wait, and then there are these great big breaths again." Blood gas measurements on such sleepers, West adds, reveal that their oxygen levels rise and fall in tandem with their breathing, in a sinusoidal pattern.

Tentmates aren't the only ones whose sleep is disturbed. The sleeper may awaken with a sudden, panicked sensation of suffocation—an experience tourists have reported at elevations as low as 6,000 feet.

All told, however, the body's ability to acclimate is remarkable.[9] A sea-level-dwelling human, suddenly teleported to the summit of Mt. Everest, would last about two minutes before blacking out—maybe a bit longer if the person first managed to get a really good breath of sea-level air. Death would quickly follow. But many well-acclimated climbers can shut off their oxygen at the summit of Everest so long as they don't move around too much (Hornbein was walking when his oxygen flow was disrupted). And Messner isn't the only one who's managed to gain the summit without any use of supplemental oxygen.

We've learned a few simple rules about altitude acclimatization.[10] One precept says not to change your overnight elevation by more than 4,000 feet a day at altitudes below 8,000 feet—and to limit changes to no more than 2,000 feet per day, above that altitude. This means that it takes more than a

[9] Many scientists are amazed at the complexity of the mechanisms that allow the human body to adjust to elevation. Some believe that these abilities indicate that humans originated on high plateaus in central Africa and have retained their ancient ancestors' adaptations.

[10] For more on this subject, see any of several popular books on Himalayan mountaineering, such as Jon Krakauer's bestseller, *Into Thin Air.*

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week to get from sea level to 20,000 feet—a severe constraint for high-mountain troops. And at 20,000 feet, even the 2,000-foot-per-day limit may be too much.[11] Other basics of acclimatization include:

- Being in good physical condition.
- Using a technique called the "rest step" for walking uphill. This involves briefly hesitating between strides while your breathing catches up with the exertion. Other activities can also be done with rhythms that allow brief rests in motions that at sea level would be continuous.
- Engaging in light exercise shortly after arrival at a new elevation.
- Forcing oneself to drink lots of water. Altitude sickness is partially caused by dehydration, as rapid breathing in thin, dry, mountain air sucks moisture from the lungs.
- Avoiding alcohol.
- Eating frequent, small meals, rich in carbohydrates.[12]

Another intriguing aspect of altitude acclimatization is that for unexplained reasons, middle-aged people are often more tolerant to altitude than are children or younger adults. Between ages 35 and 45, for example, I myself watched my headache-free upper limit move from 12,000 feet to at least 14,000 feet.

The Puzzle of VO_2max

Useful as it is for preventing altitude sickness, acclimatization doesn't allow anybody, even those born at high altitudes, to exercise as long or intensely at elevation as at sea level. Studies of long-distance runners have shown that even at elevations as low as 1,000 meters (3,300 feet) there is a measurable decline in performance. The effect isn't huge, but at 3,500 feet elevation, world-class marathoners see about a 2% drop in speed, and at higher elevations, the decline is even more substantial.

This effect can be quantified in terms of a variable called VO_2max. The nomenclature is odd-looking, but the concept is straightforward: VO_2max is simply the maximum rate at which your muscles are capable of processing oxygen in a brief, all-out effort. It's traditionally measured by putting you on a treadmill and having you run up an ever-increasing grade while monitoring your oxygen consumption. The amount you're consuming at the point where you have to call it quits is your VO_2max.

VO_2max is generally stated as milliliters of oxygen per kilogram of body weight per minute (ml/kg-min). A few elite endurance athletes, particularly cross-country skiers, have tested in the range of 85 to 90. The typical healthy young man or woman has a value of about 45 to 55. To some extent the differences are genetic, but athletic training can increase VO_2max by perhaps 15 to 25%.

Exercise intensity can be expressed in terms of the percentage of VO_2max at which your body is operating. Nobody can work for long at 100% of VO_2max,

[11] Between camps, hikers and soldiers are free to climb and descend as much as they like; it's the overnight elevation that matters.

[12] The goal is to keep up the body's energy without falling prey to high-elevation nausea. Another problem is that at really high elevations, people tend to lose weight no matter how often they try to eat. Partly this is due to loss of appetite, but partly it's because, somewhere above 20,000 feet, many people's bodies lose the ability to absorb important nutrients, particularly fats. Climbers have tested a variety of high-tech diets, with greater and lesser success. Space colonists on low-oxygen worlds will probably also need special diets or will have to commute between "outdoor" work environments and "indoor" living quarters where conditions are more conducive to digestion.

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but well-trained athletes can hold a 95% level for about 30 minutes and an 85 to 90% level for a couple of hours. Sitting around reading this article, you're using a little more than seven ml/kg-min of oxygen (the bare minimum necessary to sustain life)—or about 15% of the average person's VO_2max. A 50% level feels about like a very brisk walk.

Elevation changes the picture radically. Above 4,000 feet, South African ultramarathoner and exercise physiologist Tim Noakes reports that VO_2max falls in a manner that's linearly related to altitude.[13] At the same time, the amount of oxygen required to do any given task remains the same. At modest elevations, you might not notice that reading this article requires, for example, a 17% effort, rather than 15%, but as you pile up the elevation, simple activities become increasingly squeezed against the VO_2max cap. On the summit of Everest, Noakes reports that the average, acclimated climber has a VO_2max of only 15. This means that simply staying alive (without taking into account important additions such as generating enough body heat not to lose fingers and toes to frostbite) is a 50% effort. No wonder climbers can barely move as they ascend the last few hundred feet to the summit![14]

What allows some people to function at high elevation, while others can't? In theory, high VO_2max should help, because it gives you more cushion between your maximum ability to work and the fraction of your breathing devoted simply to staying alive and conscious. But VO_2max isn't the entire story. If it were, the best high-elevation climbers would all have VO_2maxes comparable to world-class cross-country skiers. Instead, Noakes reports that two of the greatest Himalayan climbers of all time, Messner and Sir Edmund Hillary (the first person to reach the summit), had sea level VO_2maxes of about 49. That's comparable to the average for sedentary 30-year-old office workers.[15]

People who function well at high elevation have two things going for them. One is that their movements are efficient, allowing them to get more than others do from each precious milliliter of oxygen. In screening candidates for space colonies, we therefore don't want to become so enamored with searching for high VO_2max that we ignore this factor, especially because it can be substantially boosted by experience, confidence, and proper instruction. Getting into good physical condition can also increase efficiency by reducing the amount of oxygen your muscles need for *any* task.

But efficiency is only a piece of the puzzle. What really distinguished Hillary—and to an even greater extent, Messner—was that both had mastered the art of *breathing*.

Pink Puffers vs. Bad Breathers

We noted earlier that the body responds to high elevation by increasing its breathing rate. Actually, that was an oversimplification: a more accurate statement is that this is what the body is *supposed* to do. Frank Powell, director of the University of California's White Mountain Research Station, divides the world into two types of people. Some respond to elevation by puffing, panting, and turning nicely pink; the others more

[13] These figures come from Noakes' book, *Lore of Running*, which summarizes hundreds of studies on exercise physiology and sports training.

[14] Noakes reports that it can take up to five hours to climb the last 1,300 feet. Many climbers believe that reaching the summit without bottled oxygen would be impossible if the mountain were as little as 1,000 feet taller.

[15] Noakes reports that Messner's climbing partner, Peter Habeler, had a substantially higher VO_2max, of 65.9.

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or less "forget" to breathe and quickly turn blue.

"Good" high-elevation breathing can be practiced, but for those to whom it doesn't come naturally, it requires constant attention. The primary technique is called "pressure breathing," in which you inhale normally, then exhale in a rapid puff. This briefly raises the air pressure inside the lungs, forcing more oxygen into the blood.

Another, more basic aspect of good breathing is "belly breathing." Put your hand on your stomach as you draw a breath, and watch how it moves. If you're typical of body-image-conscious Westerners, it will move upward, as you suck in your gut and expand your chest in an effort to look buff and thin-waisted. This is called "chest breathing," and many of us were taught to do it in grade school posture lessons (I was). However sexy it may make you look, chest breathing constricts the movement of the diaphragm and reduces usable lung capacity. Belly breathing causes your hand to move outward with each breath, as the stomach is shoved out of the way to make room for the diaphragm to bow downward as it draws the maximum possible amount of air into the lungs. Singers, wind instrument players, Yoga practitioners, and athletes who want to excel must all learn to belly-breathe if it doesn't already come to them naturally.[16] Residents of low-oxygen environments will need the same skill.

Good breathing is so important to high-elevation/low-oxygen work that breath classes could well be part of space emigrants' training. They may also be mandatory for children, before they're allowed to leave special, pressurized nurseries.[17]

Now, What Are We Forgetting?

So far, we've discussed altitude sickness and the limits to physical labor in hypoxic environments. But what are the impacts of elevation on mental acuity?

The short answer is "not good." Himalayan climbers regularly report difficulty in concentrating on even the simplest tasks. Partly this is due to sleep deprivation and fatigue. But the rapidity with which Hornbein's mind started to shut down when he lost his oxygen supply left him with a frightening thought: could the brain be the organ that is most easily damaged by exposure to low-oxygen environments?

Other observations support that concern. High-elevation climbers frequently suffer from small retinal hemorrhages. These have no significant impact on vision, and clear up on their own after the climb, but they could be indicators of other damage. "This makes me wonder what's going on in the brain," Hornbein says, noting that doctors often think of the retina as "the window to the brain."

Another nasty indicator of possible brain damage: the death rate on the descent from Mt. Everest is three times higher for climbers who do not use oxygen than it is for those who do use it. "This implies causality," Hornbein says, adding that it's reasonable to suspect that venturing so high without oxygen impairs brain function in ways that make climbers more susceptible to deadly lapses of judgment.

In more controlled studies, Hornbein and his colleagues have found that spending time at extremely high altitudes produces lasting changes in mental and physical abilities. Aptitude tests of spelling, pronunciation, and the ability to explain complex ideas have shown

[16] Tips on how to make the shift can be found in many health and exercise books, including my own book, *Alberto Salazar's Guide to Running*, co-authored with retired marathoner Alberto Salazar.

[17] Pressurized crèches may be critical, depending on the level of "outside" oxygen. There are indications that childhood development is impeded by hypoxia.

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impairment not only during the climb, but well after the return to sea level. Climbers have also shown lingering impairments of their abilities to make simple line drawings, and even simple motor skills such as the speed with which they can tap their fingers have showed some degree of slow-down. One study of 16 high-elevation climbers found that 13 were still slightly impaired a year after returning to sea level. Changes in brain EEGs have also been detected three to 10 months after climbers' last experiences at high elevation.

Oddly, Hornbein says, the best high-elevation breathers often exhibit the most difficulty with post-climb experiments such as word recognition tests. He hypothesizes that this reveals an unpleasant side effect of the strong breathing that makes them good climbers. In addition to elevating blood oxygen levels to power the muscles, he notes, powerful breathing depresses blood levels of carbon dioxide more strongly than does poor or average breathing. This triggers a restriction of blood flow to the brain similar to that caused by hyperventilation. And that may cause minor brain injuries, Hornbein postulates.

All of this puts a damper on the potential habitability of low-pressure space colonies. Climbers and explorers may be willing to sacrifice a few gray cells on their ventures into uncharted territory, but the rest of us would probably prefer to keep such losses to a minimum. Nor can a space colony or elite military force afford an environment that produces a continuous (and literal) brain drain on its residents.

Luckily, we have earthly models that we can draw on for inspiration for ways to offset these risks.

Lessons from the Cloud Mines

We've already mentioned that Pakistan and India have soldiers stationed at remarkably high altitudes. But other countries, including the U.S., have civilian workers whose jobs routinely carry them to nonpressurized worksites at near-stratospheric elevations. Furthermore, many of these people commute from lowland homes, magnifying the difficulties of acclimatization.

These people are astronomers and miners. In Hawaii, enough workers commute to observatories atop the 13,800-foot Mauna Kea volcano to produce a distinct rush hour on its winding summit road. In Colorado, the aptly named Climax Mine lies at 14,300 feet. And these aren't the highest such facilities in the world; in the Andes of Chile and Peru, there are sites at even higher elevations, up to nearly 20,000 feet. The technology ranges from backbreaking pick-and-shovel work to highly sophisticated earthmoving equipment that demands skilled, alert operators.

The highest worksite of all is a mine in northern Chile. Most of the employees live in the lowlands and commute to the 19,600-foot location in week-on/week-off cycles. But on a recent visit, West was astonished to find permanent caretakers who'd lived there for two years. "This demonstrates that you can live indefinitely at this extremely high altitude," he says. "I believe that these caretakers are the highest inhabitants in the world."

For years, workers at such mines and observatories simply suffered the impairments of work efficiency, mental performance, sleep quality, and general well-being that were presumed to be the price of working far above normal cloud level. In theory, they could have been given oxygen masks and bottled oxygen, but the expense and inconvenience were prohibitive.

Recently, however, altitude researchers have discovered a simple way to provide supplemental oxygen without the need to ferry thousands of cumbersome bottles to the worksite. Even slight increases in the amount of oxygen in living and working environments, West says, can markedly improve workers' ability to function. For example,

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jacking up the oxygen fraction from its normal 21% to a mere 22% produces the equivalent of a 1,000-foot drop in the equivalent altitude. The effect is proportional to the amount of added oxygen; increasing the oxygen content of an office or the cab of an earthmoving vehicle by five points allows workers to function as though they were nearly a mile lower—an enormous boon.

Better yet, this can be done with simple, off-the-shelf technology. Oxygen concentrators designed for emphysema patients can pipe 300 liters of oxygen into a room each hour, concentrating it from the thin outdoor air. These devices cost as little as $1,300 apiece and need only 350 watts of power. They use a synthetic mineral to absorb nitrogen from the air, leaving an output that's about 90% oxygen. Periodically, the devices have to flush accumulated nitrogen back into the outside air, but multiple systems working in tandem can allow a continuous flow of oxygen when that's needed. Rooms whose air is enriched in this manner do not need to be pressurized or sealed. Because the oxygen concentrators are inexpensive and use about as much power as the room lights, who cares if some of the oxygen escapes through cracks?

Tests at the 14,249-foot White Mountain Research Station indicate that with a mere 24% oxygen (enough to reduce the equivalent altitude by 3,000 feet), there are substantial improvements in mental capacity and the ability to perform physical work. Sleep disorders are also greatly reduced. Studies of Chilean miners confirm these results: those using supplemental oxygen have better memory and cognitive abilities when they return to sea level than do miners who don't receive supplemental oxygen.

Astronomers have also taken heed. Cal Tech's Chajnantor observatory, which studies cosmic background radiation leftover from the Big Bang, is located at about 16,500 feet in the Chilean Andes. Workstations in that facility are now fortified to 27% oxygen (reducing the equivalent elevation to 10,500 feet). Before the oxygen concentrators were added, West says, the workers had "tremendous problems" with the altitude. After the shift, he received a communiqué from one of the scientists saying that the facility now has a strict rule that nobody can work on the telescope or use power tools without oxygen enrichment. "There is no question that the use of oxygen has increased our efficiency enormously," the communiqué concluded.

In theory, oxygen concentrators could be used to drop the equivalent altitude all the way back to sea level. In practice, fire hazard puts a cap on the amount of oxygen enrichment that can safely be accomplished. At 26,000 feet, West says, it's safe to drop the equivalent altitude halfway back to sea level. At lower elevations he says that enrichments of up to 28% oxygen are possible—enough to allow people to function at 14,000 feet as though they were at 7,000 feet.

Oxygen concentrators have also drawn the attention of endurance athletes, who believe that living at a modestly high elevation can boost VO_2max in sea-level competitions. In support, they point to the phenomenal success of runners from high-elevation countries such as Kenya and Ethiopia.

Unfortunately, the low oxygen means that it's impossible to run fast enough in training at high elevation to hone those final increments of speed needed to perform at your best. The result is a new mantra: "live high; train low"—not practical unless one moves to a tall mountain within commuting distance of sea level.

Oxygen concentrators solve this problem by pumping oxygen *out* of your house rather than into it. (Alternatively, you can accomplish the same result by pumping extra nitrogen into the house.) This allows athletes to live, work, and train in sea-level cities while setting their

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living environments to mimic whatever altitude they choose. Already, devices to accomplish this are being marketed via runners' magazines. They could also be used to help hikers, climbers, skiers, and other vacationers preacclimate for trips to high-elevation destinations. If the technology becomes cheap enough, it might even become an add-on feature for conventional air conditioners.

Already, it's been suggested that such devices might be installed in alpine hotels, but here, the benefits aren't as clear as they are at home. Guests would probably sleep better in oxygen-enriched rooms, but altitude researchers fear that these people might have difficulty weaning themselves from the generators for the following day's skiing or hiking.[18]

Oxygen concentrators would be invaluable to a low-atmosphere space colony or high-altitude military force, providing an inexpensive way to supply oxygen to many of the places where it's most needed, including gym facilities that can help workers stay more fit than if they had no choice but to breathe the outside air.

The Holy Grail would be a portable, one-person unit. Present oxygen concentrators can supply more than enough oxygen for one person's needs; they simply need to be miniaturized (current devices are about the size of a 2-drawer file cabinet). It would also be useful to reduce the power requirements so that the user isn't burdened with a mountain of batteries. An energy-saving device might monitor the user's exertion rate via a heart-rate monitor and automatically deliver the optimal amount of gas. Those deliveries might also be in pulses, timed to the user's inhalations. That way, the device could use a tiny nasal cannula instead of a cumbersome facemask, without having too much oxygen waft away on the breeze, between breaths. It might also have the ability to store oxygen during low-activity periods, allowing a low-flow unit to fuel brief bursts of high-intensity exercise that would otherwise exceed its capacity. This would also provide an emergency backup supply in case of a power failure in a remote location.[19]

Unless the user is stupid enough to smoke a cigarette or work around open flame, a personal unit should carry a lower fire risk than oxygenating an entire workspace—especially because in an emergency it can be shut off in a hurry. This might allow higher levels of oxygen enrichment than are possible in interior habitats, permitting workers, explorers, or tourists to venture into extremely thin air.

Even the current nonminiaturized devices would be adequate for outdoor base stations, providing emergency aid for people stricken by the worst forms of altitude sickness. "I have the fantasy that one of these years there will be a structure with oxygen enrichment at the South Col [the highest campsite on Mt. Everest]," says Hornbein.[20]

* * *

[18] Oxygen concentrators could also be connected to car air conditioners for drives across mountain passes. Again, there might be a problem with "elevation shock" as people step out of these enriched environments for sightseeing, meals, or rest breaks. But a more severe problem might be ensuring that comfort-seeking users couldn't dial up the oxygen content to dangerous levels.

[19] Compressing the gas for storage, however, might require too much power for a lightweight portable unit.

[20] Other than finding someone to foot the bill, the main obstacle to Hornbein's fantasy would be making the device and its solar power system robust enough to survive Everest conditions, without being so heavy it would take an army of high-altitude porters to get it on site.

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Of Lamas, Mice, and Men

Help in finding better ways to cope with elevation can also be found in nature. Llamas, for example, have blood with unusually high oxygen affinity. Understanding their biochemistry might someday lead to medicines or dietary supplements to help humans cope with thin air.[21] Human fetuses also have hemoglobin with high oxygen affinity, helping them obtain oxygen from the mother's blood. Also interesting are the adaptations of high-flying birds and of fish that dwell in oxygen-poor waters.

Another line of research is offered by evolutionary biology. Powell's group is studying the way that Old World mice have adapted to Andean elevations since their arrival on the continent in the 1500s, when they hitchhiked with the Spanish conquistadors. These mice have now lived at a wide range of elevations long enough for hundreds of generations of divergent evolution to provide a natural field laboratory of altitude adaptations.

Most interesting of all, however, are people. Worldwide, 140 million live and work above 8,000 feet of elevation—some much higher than that. A few populations—notably Tibetans and the residents of the high Andes—have lived there for so many generations that they've had time for several thousand years of evolutionary adaptation. Himalayan climbers have long recognized the aptitudes of these people, hiring the Sherpas of Nepal for the most grueling high-elevation labors. Sherpas, Tibetans, and Andeans may find themselves in high demand for space colonies, but even if that doesn't happen, understanding the physiological adaptations that allow them to flourish at high altitudes may pave the way for medical interventions, including gene manipulations designed to introduce the same traits into the average colonist.[22]

Cynthia Beall is a physical anthropologist from Case Western Reserve University in Cleveland who's invested much of her career in comparing Tibetan and Andean highlanders to lowlanders who've spent at least a year living above 10,000 feet. She's found the three groups to have important biological differences in the ways in which they cope with their anoxic environments—a very interesting finding because it means that human biology is capable of more than one coping mechanism. Her research also means that over the course of thousands of years, isolated space colonies might diverge in even more radical manners as nature develops ever more effective ways of dealing with this stress.

Beall examined four traits in each group:[23]

- The hemoglobin concentration in the blood (related to the number of red blood cells);
- The blood's "oxygen saturation" (the percentage of its hemoglobin that

[21] This is not a new concept; the classic *Star Trek* episode "Amok Time" (written by Theodore Sturgeon) postulated the use of a "triox" drug to help humans deal with the thin air of Spock's home world of Vulcan.

[22] Issues of medical ethics aside, gene engineers needn't be limited to humans as a source of genes. It's possible that llama, bird, and fish genes could find their way into colonists who would look and act perfectly human, but have lowered susceptibility to hypoxia.

[23] She only presented the first three of these findings at the AAAS meeting. The fourth was presented a month later at the annual meeting of the American Association of Physical Anthropologists, in Kansas City, MO. For more details, see Jessica Gorman, "Breathing on the Edge: Going to Great Heights Hurts, and Scientists Are Learning Why," *Science News* (Vol. 159), March 31, 2001, pp. 202-204.

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carries oxygen at any given moment);

• The "ventilation rate" (the amount of air breathed per minute); and

• The lungs' production of nitric oxide.

Nitric oxide is important because it is a natural vasodilator (a compound that causes blood vessels to enlarge). Portions of the lungs that produce a lot of it have a strong blood flow, while those that do not have a weak one. People with chronic lung disease produce less nitric oxide in damaged portions of their lungs than in healthy sections, thereby shutting down the damaged sections in favor of the healthy ones. Beall wondered if the normal hypoxia from high-altitude environments might fool the body into thinking the entire lung was damaged, causing it to shut down the blood supply everywhere, exacerbating its hypoxia.[24]

For the acclimated lowlanders, the only surprise was that their resting ventilation rates (which increase markedly when people first move to high altitude) return to sea-level normal after a year's acclimatization. As expected, these people did have higher hemoglobin concentrations and lower oxygen saturation than the sea-level norms, with the effect increasing with altitude. And they do indeed make less nitric oxide than people residing at sea level.

Beall refers to this combination of traits as the "ancestral" response to altitude, because the Tibetan and Andean highlanders' distant forebears presumably had the same traits before they moved to the uplands.

The Andeans, Beall found, retain the ancestral response for hemoglobin concentration and ventilation rate. But a subset of them had unexpectedly high oxygen saturations—a clearly beneficial adaptation. Even more interestingly, the Andeans produced 50% more nitric oxide than healthy sea-level dwellers.

The Tibetans, on the other hand, showed the ancestral response for oxygen saturation but had ventilation rates that rose with altitude, averaging 50% higher than the sea level norm for residents of villages at 13,000 feet. They also diverged from the ancestral response by not making extra hemoglobin unless they lived above 13,000 feet. This too, may be a beneficial adaptation, since (as we noted earlier) thicker blood doesn't circulate well to peripheral capillaries. Finally, the Tibetans had a much stronger nitric oxide response than even the Andeans, producing twice as much of the chemical as lowlanders.

Which of the three responses is best? Beall measured what she calls the "maximal physical work capacity" of all three groups—basically, VO_2max. Not surprisingly, all three suffered by sea level standards. Equally unsurprisingly, there was enormous variation among individuals; just as with sea-level populations, some upland dwellers are better natural athletes (and better conditioned) than others. But she found more extremely high

[24] Beall's examination of nitric oxide meshes intriguingly with the Swiss researchers' examination of vasodilators and high blood pressure in the lungs of HAPE-susceptible individuals. Although Beall was looking at healthy subjects, not those suffering from altitude sickness, it would be interesting to know how the nitric oxide levels of the Swiss researchers HAPE-prone individuals compared to those of nonsusceptible individuals. The two studies came out within a month or two of each other, however, and neither set of researchers appears to have been aware of the others' work.

[25] These results are confounded, however, by the prospect that the Tibetans and Andean people might live more active lifestyles than lowland immigrants. If so, many would be in top physical condition, with high work capacities due to this cause rather than genetic adaptations.

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Table 1. Altitude adaptations of acclimated lowlanders, Andean highlanders, and Tibetan highlanders.

Population Group	Hemoglobin concentration	Oxygen saturation	Ventilation rate	Nitric oxide production
Acclimated lowlanders	Increases with elevation.	Decreases with elevation.	Initially rises with altitude but eventually returns to sea-level norm.	Decreases with altitude.
Andean highlanders	Increases with elevation.	Varies among individuals, with some having significantly higher saturations than lowlanders.	Same as residents at sea level.	50% higher than sea level norm.
Tibetan highlanders	Constant in villages at elevations up to 13,000 feet, then increases with altitude.	Decreases with elevation.	50% higher than sea level residents.	Double the sea level norm.

work capacities among the highland populations than among the acclimated lowlanders, suggesting that these people's physiologies are indeed better adapted to cope with elevation.[25] Similarly, studies of birth records show that both highland groups have bigger babies than do altitude-dwelling lowlanders—a traditional indicator of better overall health.

The bottom line is that serious altitude research is a young science, barely older than the space program. It was less than 50 years ago that Everest was first climbed, and little more than 20 years ago that Messner proved that it could be done without supplemental oxygen. Since then, climbers have continued to push back the envelope of what had once been viewed as impossible, while research on the "hows" and "whys" of what makes it possible opens the doors to refined training and ever-greater exploits.

On Earth, of course, the conquest of Everest ran us out of "up" in which to explore (at least on foot). In space, we've not even begun to find our limits.■

> To different minds, the same world is a hell, and a heaven.
>
> —Ralph Waldo Emerson

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BIOLOG Jay Kay Klein

Richard A. Lovett, J.D., Ph.D. is a writer and photographer—his letterhead says so. Rick began his career path with a B.S. in Astrophysics in 1975, followed by a J.D. in 1978, an M.S. in Economics in 1979, and a Ph.D. in Economics in 1981. Sometimes, Rick thinks he missed his calling as a geologist. A whiz at complicated math; in physics and other classes he often leaped ahead into more advanced areas, educating himself beyond formal instruction. However, this University of Michigan graduate started on the usual academic career of teaching economics and law.

Rick really loved to write, having started in grade school with an unfinished sequel to a Heinlein juvenile novel. He devoured Asimov, Clarke, Heinlein and other *Analog* writers. His one setback came with fiction, collecting rejection slips from *Analog* and other SF magazines. Over the years, Rick has found that if something didn't actually happen, he has trouble making it up.

Distant vistas and intriguing aspects of science shaped his life. Rick loved to visit wild, lonely, far-off places, with long hikes and camping out. He compares these places to what Mars and other worlds might be like for an explorer. In 1999, he bicycled a solo circuit of Iceland for three weeks. The next year it was three weeks of backpacking in Iceland, along with a visit to Greenland. Rick also considers himself a desert rat who knows the fault-block mountains, Pleistocene lakebeds, and sage-juniper desert of eastern Oregon better than most indigenous ranchers.

Rick's diverse knowledge enabled him to sell non-fiction very quickly. Articles and books on the environment, bicycling, cross-country skiing, and marathon running came naturally from his own experiences. In 1986, his first article appeared on bicycling, just as Rick pedaled 5400 miles in ten weeks between Sacramento and Maine. Editors realized Rick had a gift for explaining difficult topics, and his resume includes articles on toxicology, food safety, analytical chemistry, nutrition, agricultural biotechnology, epidemiology, cardiology, and other assorted and seemingly mutually-exclusive topics. Writing full-time, he now has six books to his credit and over 2200 articles.

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At SF cons, Rick is sure to be on panels titled, "How to write about things you know nothing about." On one panel, John G. Cramer gave him insights into articles suitable for *Analog*. Within the year, Rick's first science-fact piece on analytical chemistry ap-

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Photo courtesy of Vera Jagendorf

peared in the April 1999 issue. That first sale meant as much to him as his first sale to a prestigious general market one year earlier. Writing for *Analog* was downright fun for Rick, requiring him not only to get things correct, but also to allow his mind to speculate and synthesize while delighting readers, editors, and himself. He feels *Analog* can draw on many writers for physics, so he gravitates towards geology, ecology, chemistry, and the earth sciences.

Some of Rick's material comes first hand from scientific symposia. Taking notes on a laptop at seventy words per minute, he has often piled up as much as 150 pages. His gatherings from various sources undergo a synthesis, often mixing with other disciplines.

Rick's photography is of professional caliber, and some editors think of him as a photographer rather than a writer. The far-away places he hikes and bikes receive first-class travel photography.

Rick sees the world and its people as one interlocked place of existence. Articles that explore the range of interrelated sciences and human experiences are welcomed in few places other than *Analog*. He hopes his stirred-together articles will lead readers to bring new insights of their own to the subjects. As a Presbyterian Elder, he ponders the relation of man to the natural world, and thinks that interdisciplinary thought is a route to much true wisdom. Perhaps such synergies are a major part of how God works His wonders.

In the general markets, Rick wants to inform the readers about aspects of nature they have not thought about before. For the more sophisticated *Analog* audience, he wants to share the fun of science with like-minded people. As John W. Campbell, the long-ago editor of this magazine said, "In *Astounding*, astronomy is cheesecake." ■

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Irena's Roses

Marissa K. Lingen

Illustration by Janet Aulisio

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Finding a better way
may require risking a worse one.

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For a Friday afternoon, the clinic was quiet. We usually had one or two crises—I firmly believe there's something about illness that can sense an impending holiday, however brief. But that afternoon there were no phone calls, no drop-ins; the regularly scheduled patients came in and went docilely home—or, more commonly, back to their wards. I was thinking of letting Regan, our head nurse, go home for the few minutes left in the afternoon, when she ran into me in the back hall. Regan is the next best thing to psychic.

"We have a problem, Jean. Mr. and Mrs. Ducasse left their prescription sitting on the counter when they left," she said.

I sighed, but didn't swear—it's unprofessional. "Okay, what pharmacy do they use? Can we call it in?"

"I checked that—it's unlisted. They live out on East Clinton Road." Regan didn't say: right on your way home. She didn't need to.

"Okay. I'll drop it off on my way home."

Regan beamed. "I wrote the address down. Here." It was already stuck to the prescription chip. I glanced at it before shoving it in the pocket of my beige jacket. I tried not to think about how this would delay getting out of my work clothes.

Irena Ducasse was on antidepressants, as most of my patients were. It didn't do much for their condition, but it made them less likely to hurt themselves. There wasn't really much else we could do for Milton-Shattuck patients, although we were doing all sorts of experiments with environment, diet, and gene therapy. Nothing worked as more than a stopgap. Made my job frustrating. We were so used to gengineering being the solution, not the problem.

Irena was exceptional in most ways. The symptoms had started when she was twenty-seven, the earliest case on record. She was a painter—maybe she had better ways to channel intense sensory input. I don't know. But she handled it better than most. I don't mean to imply that she was okay, but she managed to interact with other people in an almost normal way. She stayed in her home, at the insistence of her husband, Paul, and I hadn't seen any problems with that yet. He took care of her with a fierce tenderness.

The Ducasses lived up in the hills east of town, at least half a mile from anything. The summer had burned the grasses a uniform golden brown, and there were no trees near the front of the house. I thought I could glimpse the green of a back garden through the chinks in the privacy fence. I could imagine Paul cultivating roses while his wife slept.

I pressed the visitors' button. Instead of the discreet personal alert I had expected, an old-fashioned chime doorbell rang, audible to me outside. My first sign of trouble: I wondered if the noise would upset Irena.

But Irena herself answered the door. "Hello, Dr. Derner." She smiled gently.

"Hello, Irena," I said quietly. "Is Paul at home?"

She drew in a deep breath. I jumped a little when she *sang*, projecting a warm alto: "Paul. Dr. Derner is here."

"I'll be down in a minute," boomed Paul's voice in what I recognized as the opening notes of a Bach chorale.

She shrugged. "You heard him. Come sit down." I followed my patient into their sitting room. She moved, as always, as though she was ever so slightly tipsy. Her movements all had an unsteady care to them, a deliberation rare among Milton-Shattuck patients, who used most of their energy just to deal with the outside world. Her clothes—worn, loose cotton—almost converted care into grace with their flow around her thin limbs. I gathered that they must have been old favorites from her painting days, because they had oil paint stains all over them.

I was paying close attention to Irena,

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but I had to conceal my dismay at their house. The Milton-Shattuck wards, and (more rarely) the private homes where patients lived, were decorated with simple furniture in pale shades of beige and gray. Surroundings were designed to mute sounds quickly, to absorb odors efficiently, and to minimize variety of tactile sensation. Fabrics had been specially designed to feel as much like skin as possible.

Paul Ducasse could not have been unaware of these procedures. It disturbed me to know that he was deliberately flouting them.

The living room seemed designed to overstimulate even normal senses—smoothly carved cherry-wood furniture with velvet upholstery, heavy old-fashioned curtains, wood floors covered by a sumptuous Persian rug. The colors were deep burgundies, accented with navy and forest green. The entire place smelled of baking banana bread. *Swan Lake* was on a large stereo; Irena sunk onto the couch. I was afraid she was overwhelmed by the spectacle, but she seemed perfectly comfortable, humming along with the Tchaikovsky.

"Can I help you, Dr. Derner?"

I had not heard him come in. "Mr. Ducasse. You left Irena's prescription at the clinic."

"I see. Thank you for bringing it." He held his hand out for the minichip. I hesitated. He waited.

"May I speak to you alone, Mr. Ducasse?"

He sighed. "All right, Doctor. Irena, will you excuse us?"

"Mm-hmm."

He gestured for me to follow him through the house and out to the back garden. Just as I suspected, it was filled with roses; huge pink and white ones.

I nodded to the flowers. "They're lovely."

"They're Irena's."

My professional temper snapped. "Mr. Ducasse, what kind of a game are you playing with your wife's health?"

"I'm sure you think you know what you're talking about, Dr. Derner."

"Yes, after spending most of my adult life studying and working with patients like your wife, you're right: I do think I know what I'm talking about. Perhaps because Irena has had a manageable reaction to her condition, you think it's acceptable to push her to her limits. Well, I don't think it's acceptable at all. Now, I'm going to give you the benefit of the doubt and assume that you thought this better for Irena—I'm not going to call the Board of Health on you for abusive behavior towards a mentally incapacitated individual. But Irena can't live in this condition any longer. If you won't change her surroundings, I *will* have her taken away from you."

"I'm telling you: you don't know what you're talking about. But I'm willing to try to teach you."

"Teach me what?"

"How to care for someone like Irena."

"And you know this better than I."

"Yes."

"Despite your total lack of medical training, much less expertise in this field."

"Yes."

"And why is that, please?"

He sighed. "Dr. Derner. Are any of your other Milton-Shattuck patients like my wife?"

"I don't know what you're getting at."

"You've had Irena as a patient for, what? Almost eight years now?"

"Eight years in May, yes."

"You seem to think my wife's condition is despite her surroundings, but tell me: have you ever seen a Milton-Shattuck patient as well-adjusted as Irena?"

"Irena is unlike a typical Milton-Shattuck patient in many ways, not just her environment," I said frostily.

"But you admit that her environment might play a part."

"In general, yes, but I hardly fail to see how drowning her in sensory experiences could *fail* to be harmful."

"If *you* had the vision of the prover-

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bial hawk, how would *you* like to look at beige walls all day?"

"Rhetoric is a wonderful tool, Mr. Ducasse, but it by no means constitutes scientific proof."

"Come on, Dr. Derner, surely you're not claiming a full scientific understanding of Milton-Shattuck."

"The partial understanding of patients acting as if they were in extreme pain when confronted by intense sensory experiences seems to be quite enough to go on."

"No, it's *not*," he said forcefully. "Do you know what's different about this house? Irena picked it out. All of it. The colors and shapes she loves, the sounds, the smells—everything. The intensity only hurts her when it's *bad*. People almost always compare Milton-Shattuck induced smell to a bloodhound's. Have you ever seen a bloodhound when he scents steak?"

"People are not dogs. A bloodhound is not self-aware, and he has his sense of smell from birth—it's normal to him. Neither of those things are true of your wife."

Paul sighed. "We won't quibble about the self-awareness thing. Look, I'm not asking you to just take my word for it. Come back some day when you're not busy and observe all you want. Try it with some of your own patients, in small ways—ask them what they want to look at, what they want to eat. Listen to the details. *Try* it. Don't just dismiss it out of hand. Look at how well Irena is doing."

I sighed. "All right, Mr. Ducasse. I *will* come back to observe—you're not off the hook on this. But I won't start a court action. I hope that's enough for you."

"It's all I could expect."

"Fine."

When we walked through the living room, Irena was gone. It was such a lush, detailed place. I had observed it with my doctor-eyes, but it might have jumped out at anybody. The burgundy velvet sofa had a new splotch of bright yellow paint in the middle of it.

Irena Ducasse was still painting.

I spent the weekend taking long hikes by myself, as usual, but I was preoccupied—for obvious reasons. Giving a Milton-Shattuck patient a palette seemed like putting an albino under a tanning lamp.

So I had to go in and talk to Chen on Monday. Diane Chen is a tough lady and a dedicated boss. Most nights she spends on a cot at the hospital. I think she's almost gotten used to the beige and gray we work in every day, and nobody can get used to that. Chen goes by the book—she practically *wrote* the book—but she still defers to the Board of Directors in every case. She was an intern when Julia Shattuck began to get the first symptoms.

It took them all awhile to figure out what was wrong. Of course Julia's genemap was on file, but an antiaging modification was not intuitively the place to look for a cause of reported hallucinations in a thirty-three-year-old. By the time there were other cases, by the time things started to make sense and the medical profession could tell Julia she was *not* hallucinating but rather sensing amplified details, she had already tried suicide twice. Chen was there to bring her back from one of them. I always thought about it when I went into her office, about what it must have been like to be the first and not have any clue what was going on. I thought I could understand pretty well, actually.

"What's on your mind, Jean?" she said. I sometimes forgot my first name wasn't "doctor."

I told her about how I went out to the Ducasses. To make it concise, I left out most of the details about the house—the smells, the noises, most of the worst of it. If something offends your sight, it's easy to close your eyes. Milton-Shattuck patients have a much harder time with other senses, because there's no "off"

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switch like that. But when I got to the last part—my suspicion that Irena was still painting—Chen went still, like a hunting dog scenting a bird.

"We have to tread carefully with this one, Jean," she said, almost eagerly.

"I know."

"I'd suggest that you take Mr., ah, Ducasse up on his offer of a visit. Be prepared to ask tough questions, and do not let them leave any door unopened. We need to be able to defend your investigation to the Board of Directors if that becomes necessary. We have lots of resources on the proper care of a Milton-Shattuck patient; I'm sure he could benefit by them."

"So you think I was right not to start criminal negligence charges right away?"

She sighed. "It's a tough call. Hell, you know that; you've been living with it since Friday. But I'd say we can go slowly on this one—the patient doesn't seem severely affected yet, and we don't want to be forced to press criminal charges against an essentially well-meaning man if he can be convinced to care for his wife appropriately. I think the Board could understand that."

I ignored Chen's obsessing about the Board and thought about Paul Ducasse. "He adores Irena, I think. I would have said it was a sure thing before I visited their house."

"Family members often have some misunderstandings about the disease and a good deal of resentment towards it. Understandable, really." She shuffled around some papers on her desk. "I think you've got a good idea how to proceed here, Jean. You've done well so far, but don't be afraid to get insistent if the situation calls for it. We are the trained professionals, after all. Nothing should prevent Mrs. Ducasse from receiving adequate medical attention."

I thanked her and left. When Paul brought Irena in for her weekly visit, I said, "You're not off the hook on that visit, you know."

"No, of course not. Do you have any free afternoons this week?"

I grimaced. "Hardly. How is your weekend?"

"Saturday afternoon would be fine for us. Do you have any hot plans for Saturday, Irena?"

"No," she said, watching me with wide eyes.

"Saturday it is, then," I said. "Two o'clock?"

"Fine."

It was that simple. I pulled up promptly at 1:58, and Irena was waiting for me just inside the gate. "Hi," she said.

"Hi. Is Paul around, or are you going to give me the tour?"

"Both," she said happily. "Have you seen my roses?"

"Yes. What else do you have?"

"My studio. Come on!"

She was acting so childlike I felt like I should take her hand, but I knew better than to touch Milton-Shattuck patients without warning or invitation. I followed her into the house, where the smell of cinnamon hit me like a wall.

"Paul made rolls," she explained. "Paul!" She was singing again. "The doctor is here!"

"Come on into the kitchen," he caroled back.

He was setting a full plate of glazed cinnamon rolls on the table. "Good afternoon, Doctor. Do you drink tea?"

"Yes, please," I said. I really wasn't sure how to proceed with the visit. It seemed best to let them show me what they intended to show me first, and then confront Paul with the danger to his wife's mental state once I knew what was going on.

He brought cups to the table, then paused. "Black tea or herbal?"

"Herbal, please."

"Why am I not surprised," he murmured. "We have chamomile and cinnamon cardamom."

"Chamomile." He winced. I wondered if it brought up bad memories but

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decided it was none of my business.

"Cardamom for me," said Irena.

Paul smiled. "I know, dear."

"He takes such good care of me," Irena informed me.

"The doctor thinks you're just saying that because I told you to," murmured Paul, pouring steaming water over my tea bag.

I sipped at the tea. It was almost exactly like the stuff my mom made when I was little, and I told them so.

"My mom used to make chamomile tea, too," said Irena.

"Everything in this house is something Irena picked out," Paul explained.

"Including you!"

I thought for a moment she meant me, but she was laughing up at her husband. He sat down and took her hand. "I mean that literally, Doctor. Irena has selected everything in our home. When she started to feel the onset of Milton-Shattuck, we totally remodeled. We spent hours in furniture and carpet stores, letting her feel and smell and look at everything very carefully. This is the perfect environment for my wife."

"It certainly looks like you've gone to a lot of work for it," I replied diplomatically, taking another sip of my tea. I never got the right trick of drinking it so that it didn't burn my tongue and didn't get cold before I was done. I was eager enough to get the whole afternoon over with that I decided to go with the tongue-burning route.

Irena sipped hers slowly. I guess I would expect that: the last thing a Milton-Shattuck patient needs is amplified pain. Paul was slow, too, and I couldn't tell whether that was because he was used to Irena or whether he was trying to stall me.

Finally, Irena finished the last slurp of her tea. "Now do I show her my studio?"

"If you like, love," said Paul. "Why don't we take her on a quick run through the house on the way?"

Irena took his comment quite literally, nearly jogging us through the rooms. "And this is the dining room!" she called over her shoulder.

"You're letting her paint," I said.

He laughed. "It's the best thing for her."

"That's just cruel."

"If it was cruel, would she be racing ahead to show you?"

"Do you think she's been misdiagnosed?"

"Now, really, Doctor. How many conditions could be mistaken for Milton-Shattuck? Maybe her paintings will help you understand."

I thought maybe he had gotten her some muted colors, but when we got to the studio, I wasn't sure where to look first. There were paintings stacked against each other, hung on the walls, propped in the corners.

"This is my new one," Irena announced, leading me to an easel by the window. "Strawberries."

It did not look like strawberries in any naturalistic sense—that is, it was clearly not a photograph of strawberries. But somehow, she had captured the explosion of flavor that came with the first bite, the seedy outside texture and the firm inside. If she had not told me it was a strawberry painting, I still would have known.

And strawberries are not meek or muted flavors. I looked at Paul, who had been watching my reaction. He glanced at the paintings, then quickly back at me. "Quite something, isn't it?" he said.

"Quite," I said. "Is she still selling them?"

"When she wants to."

"It's my choice," said Irena earnestly.

I realized I hadn't spoken to her directly about the whole thing. Maybe her strength of will was carrying her through, and I didn't know how long that could last. "Does it hurt you to paint these, Irena?" I asked gently.

"How could it hurt to paint?" she demanded, looking at me like I was an idiot. "It hurts not to paint."

I looked at the painting again. I could

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almost believe it would hurt to keep that kind of thing inside. "But when you look at the colors. . . ?"

Paul grinned at me. "Give it up, Doctor. She's already ruined your theories. You might as well admit it."

"Do you like my paintings?"

I looked around at the other ones. "Yes," I said slowly. "Yes, I do."

"I thought you would. Do you want to see my roses?"

"I saw your roses when I was here last time," I said.

"Didn't you like them?"

I sighed. "Yes, I liked them. All right. We can look at your roses."

We thumped back down the stairs to the back garden.

"Don't forget your sunglasses," Paul said, hurrying after her.

"Thank you." Irena slid them on as we made our way out to the garden. The day was clouded, but Milton-Shattuck patients are mildly photosensitive. She leaned over and buried her face in a particularly brilliant blossom. "Mmmm. Smell that? They're not like American Beauties. Much better smelling."

I smelled. "They're very nice."

A gentle chime sounded from inside the house.

"Why don't you get the phone, Irena?" Paul suggested. She floated in after it, humming to herself.

"That's a rather pleasant ring," I said. "It's almost a real *ring*, like bells, instead of the alarm-clock sound most of them have."

He squinted at me, shading his eyes with one hand. "Irena picked it out. Of course. We got our number changed when her syndrome started to get really bad, and only her family and best friends have it. And you, I believe. The number should be in your records."

"I'm not sure it is."

"I can give it to you. I know you would understand better than anyone else not to abuse it." I followed Paul into the kitchen, where he wrote the number on a scrap of paper for me. I tucked it into my pocket.

"I'm not expecting miracles, Doctor," he said. "But I'd really like you to think about what you've seen today. I don't know if Irena is just significantly different from the rest of your patients or not, but I'd really like it if you'd consider her environment. You've done other tests on her—you know how sensitive she is to unpleasant noises and so on. You know how sensitive she is in general."

I nodded slowly. "I can't promise anything. But you've certainly given me something to think about."

In the next room, Irena was giggling at something the person was saying on the other end of the line.

"She's . . . so childlike," I said. "Was she always like that?"

"Not as much as she is now, no. But she always took so much joy in simple things. She's always been very loving."

"She certainly is that. It's a pity you never had children. She would have been an excellent mother."

"While she could have been," he said curtly. "It's probably just as well for both of us."

"I'm sorry. I didn't mean to—"

"No, it's all right," said Paul. "I came to my peace with this condition a long time ago."

"I'm sure."

There was very little else we could say, and I had already seen everything around the house. I was going to wait for Irena to get off the phone so that I could say good-bye to her, but it sounded as though she might be awhile. I waved at her as I passed through on my way to the door.

"Wait, wait!" she called after me. "Hold on just a sec." She set the phone down and ran to hug me. I reciprocated awkwardly. "Just remember," she whispered in my ear. "You saw the strawberries and the roses. Remember who made them possible."

There had been something tickling in the back of my mind, and I finally fig-

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ured out what it was. There's not really a way to measure how severe a case of Milton-Shattuck is, because the effects are so subjective. The only way we have to gauge the extent of the disease is the patient's reaction to the outside world, and it's hard to tell how much of that depends on the severity of the disease and how much is from the individual personality. To try to track these things, as we get a larger pool of subjects, we keep reactions and psychological profiles in a database, for each patient treated in the country. I needed a data search.

Irena Ducasse had a pretty archetypal artistic personality. Of course I couldn't find Irena clones in the database, but if I could pick out some strong traits and check out other patients, I could see if her reaction was typical of artists. If it was, her husband would not be able to argue that it was her extreme surroundings that made her better adjusted than most. It would at least weaken his argument.

A quick dive into the data left me more frustrated. Of the thirteen artistic personalities in the records, three had managed to escape the wards to commit suicide. Two more had killed themselves within the confines of the wards—proof positive, I thought grimly, that Milton-Shattuck doesn't decrease creativity. Those wards are safer than most maximum security prisons. Seven existed in the wards in catatonic states, tube-fed and totally vegetative. The last one was Dennis Shakker, in one of the local wards I rarely visited. He had been there for ten years. His records said that he was heavily restrained but still reactive to stimuli.

Reactive to stimuli, I discovered when I met Dennis, was a vast understatement. Dennis was a mumbler, sometimes giving a running unhelpful commentary on his surroundings, but mostly just not filtering his own thoughts. And really, I thought, how much can there be to comment on in a Milton-Shattuck ward?

"Good ol' Randy, just lying there on his back," he muttered. "Randy, Randy, Randy, lying, bet he sees everything twice. And where are the snow-Randys of yesteryear? That's what Joe wants to know."

Randy, I saw, was the vegetative patient in the next bed over, but Joe was nowhere in evidence. "Dennis, my name is Dr. Jean Derner. I have a few questions for you."

"He's a good man with the ball, and who's as fast as they used to be? Laying their eggs in the sand, just like Newton. Whatcha doin', Doc? Or should that be 'what's up?'"

"I just had some questions, Dennis. Do you remember coming here?"

"I've always been king."

"Excuse me?"

"You might as well be, if you have to live in a nutshell. Or an eggshell."

"Do you like it here, Dennis?"

I thought there was a lucid flash in his eyes, but it was angry as Milton-Shattuck patients almost never are. "Oh, yeth, Doctor," said a sweet little voice coming from his mouth. "The porridge ith thplendid. And Nurthe Joneth ith jutht like a real mummy."

I sighed. "Do you like chocolate?" I whispered.

There was the canny look again. "I'm not allowed."

"I'm a doctor. I can prescribe it."

He nodded eagerly. I unwrapped a Hershey's kiss and popped it into his mouth. His face relaxed into bliss.

"Is there anything else you like?" I said gently.

His voice sounded as though it came from very far away. "Fresh-squeezed orange juice. The Beatles, but none of that White Album shit. I would—oh, God, I would rip Joe's throat out for a pretty girl in a bright red dress. And roses."

There was Joe again. And roses.

"I'll do what I can, Dennis. Okay?"

His eyes would have been utterly unremarkable, a bland mix of brown, gray,

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and green, had they not been so firmly fixed on my face. They were trying to grip me, to present strength. Instead, they clung. "I'll do the best I can," I repeated.

"I'll remember."

"Dennis . . . what did you do before you were in here?"

He winced. "Nothing."

I sat there regarding him for a moment.

"Nothing, I told you, I did nothing!"

I became very glad he was restrained, when suddenly he relaxed again, sagging backwards. "Nothing worth mentioning, anyway."

I checked the computer library when I got home—not the Milton-Shattuck databases, but the public records, on a whim. I don't know how I missed this one, except that I was in med school at the time, immersed in my studies. Dennis Shakker had been the keyboard player for Faraday Caige, the hottest electro-rock singer of the decade. He wrote a lot of the songs, or so it seemed, but the biggest press always went to Caige—the great digital music innovator, they called him. The only time Shakker got his own stories was the last concert he played, when he started screaming and trying to tear the instruments away from the rest of the band. His Milton-Shattuck syndrome was diagnosed, and he was locked away into permanent obscurity.

How would it be, I wondered, to have awareness of all flaws, all wrong notes, missed beats or worse, miswritten intervals, rhythms that sounded just off. To have it surpass the usual artistic self-criticism, to have it amplified into the realm of physical pain. How lucky Irena must be, to be able to stand her own work while she did it.

I picked up the phone and dialed Paul Ducasse. "I'll help you keep your wife," I told him.

"Dr. Derner? That's wonderful. Thank you so much."

"It's on a provisional basis, of course—I'm going to start working on getting an experimental grant for alternative treatments of Milton-Shattuck, and I believe we'll be able to—"

"But Irena can stay in our house."

"I'll fight for her."

"Dr. Derner, you have no idea what this means to me. What it means to Irena. Oh, thank you."

I smiled. "I think I have some idea."

"No, really, you don't. Thank you so much!"

I started the paperwork as soon as I got off the phone with Paul. There were lots of hoops to jump through, and I was only done with two of the twelve forms before lunch. My afternoon was taken up by seeing patients, and when I finally managed to step into my office for a quick break, the phone was ringing. I picked it up wearily.

"Hello?"

"I can't believe you would do this to us."

"Excuse me?"

"Why did you even bother to lie about it?"

"Who is this, please?"

"They came and took her just now."

"Mr. Ducasse? Please calm down. Who took whom? Irena? Is something wrong with your wife?"

"You're damn right there's something wrong with my wife. Your hospital goons just came and got her and hauled her off to your nuthouse."

"What?"

"Don't play with me, Doctor."

"Honestly, I have no idea what you're talking about. Who came for your wife?"

"They came from your hospital with papers signed by your boss. And you're trying to tell me you know nothing about this? They said if I didn't let them take her, they'd have to send in the police. That I was guilty of criminal negligence. This is going to kill her, Doctor. And maybe—"

"I really had no idea that this was going to happen. I certainly didn't order it. I know you have no reason to believe me, but I swear it's true. I'll go talk to Dr.

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Chen right now, okay? We'll see if we can get this straightened out."

"You'd better," he said. "It will kill her to be in a place like that. You know it will. You saw her on Saturday. She needs to be at home."

"I know, Paul."

"She needs me."

"I know. I'll do the best I can."

"You'd better."

I would like to say that I stormed into Chen's office, demanding Irena's immediate release. Actually, I called her secretary to make sure she had a little free time for me to discuss a patient. I made an appointment and entered the inner sanctum calmly.

"Which patient were you wanting to discuss?" Chen asked me. It took a minute for me to see she was being disingenuous. She knew full well.

"Irena Ducasse," I said angrily. "I never gave any orders for her to be taken from her husband. I never recommended any such thing."

Chen frowned. "But you were going to. Weren't you? I mean, you went to see them this weekend, and she was still in that environment. Even if the husband is going to make housing changes, it'll take awhile. Isn't that right?"

"I'm not convinced he needs to make housing changes," I said quietly.

"What? Oh, that's ridiculous. Come on, Jean, you know better than that."

"She was doing fine at home."

"For how long?"

"I don't know how long! She'd been doing fine for eight years—that seems like long enough to prove that it's not going to drive her immediately nuts."

"The Board of Directors would see it differently."

"Oh, come on! There's no reason to bring the Board in on this. For a Milton-Shattuck patient, Irena is pretty good."

Chen sighed. "The patient has required heavy sedation for most of the day. As for the Board, at least one of the members has already heard of this situation. I'm not sure your professional judgment is intact as to what constitutes 'pretty good.' Maybe you've been around the extreme cases for too long."

"She never had to be sedated when she was living with her husband. Never once."

"I'm not going to argue with you on this one. We know how to handle Milton-Shattuck patients. If you've forgotten, I suggest you take a leave of absence to study the material again."

I was silent.

"Are you going to need to take a leave, Jean?"

"No."

"I'm not sure of that."

"We're understaffed already! If I went on leave, who would look after my patients?"

"Someone who didn't throw professional credibility overboard for a pretty face?"

I tried to keep my tone steady. "I resent that remark immensely. You had no grounds for saying that."

"What am I supposed to think? You've never behaved so irrationally before."

"So anyone who questions your methods is irrational?"

"Anyone who tries to throw away decades of research, yes!"

I stood up, turning away.

"Jean. Are you going to be able to treat this case professionally or not?"

"I will play by your rules," I said, "but I will also be applying for a grant to study Paul Ducasse's methods on Milton-Shattuck patients."

"Apply all you want, but do it on your own time."

"Of course," I said stiffly. I turned back to her. "Then yes, I can conduct this case 'professionally.'"

"Thank you."

I left without saying anything else and made the hardest phone call of my life.

"What do you mean, there's nothing you can do? Don't give me that. You're her doctor—of course there's something you can do."

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"Paul. Listen to me."

There was a low moan on the other end of the phone.

"Paul?"

"Lower your voice. Please."

"Okay, okay. But listen. If I press the case for Irena right now, Chen will get the county to sue me for malpractice as well as getting you on criminal negligence, or possibly abuse. She's terrified of the Board, or public opinion, or whatever. Maybe of being wrong. Anyway, she thinks she knows best, and fighting her will get Irena nowhere."

"She'll get nowhere this way. Worse than nowhere."

"Please, try to calm down. If I—"

"I will listen to you," he said in a voice brassy with fury, "but do not ask me to calm down."

"If I continue to treat Irena, I can slip her little things, things that will make her stay more bearable. I'm applying for funding to study Milton-Shattuck, and if I can get the money, we can try to get Irena in my study. Which would basically mean sending her back home with you. But we have to wait until we hear on it."

"I don't know if Irena *can* wait."

"I don't see that you have another choice."

There was an utterly still silence on the other end of the line. "All right. We'll try this your way. But if you drive my wife over the edge, your life is mine."

I'd never been threatened before. Milton-Shattuck patients and their families are usually, if anything, *too* placid. "I will do my best for your wife. As I have for the past eight years."

"All right, then."

Paul visited Irena every morning and again every afternoon. He talked to her, sang to her, and brought her things. She came out of her panic fairly quickly, but she was sullen and uncooperative except when he was around. Sometimes when I brought her little things—chocolates were the easiest to hide—she would respond to me, too.

When I started a promising dialog with a biomedical research firm concerning funding of my project, Paul began to warm up to me, and Irena followed his lead. Paul was in on my first meeting with the trustees of Dennis Shakker's estate, too; when I quietly showed his mother and his brother what a little chocolate or a tiny bit of color could do for Dennis, the money was as good as ours. The look on Paul's face was almost as instructive. I was hoping we were beginning to rebuild a trusting relationship, until one morning about three months later.

I had finished my usual morning small talk with Regan and had turned to the subject of the patients. "And how is Mrs. Ducasse this morning?"

"She's a little upset, Dr. Derner."

I slugged back some black coffee. "Why's that? Do you have any idea?"

"Mr. Ducasse hasn't been in today."

I looked at her sharply. "He hasn't."

"No."

"Has he called?"

"Not a word from him."

"That's odd." I put calling Paul first on my to do list that morning, but there was no answer. I called their other emergency contact number, his sister. She had heard nothing from him. The little things began to add up.

"Regan!" I called. "Regan, I'm going to be out of the office. It may be an emergency. I'll call for ambulance backup if I need it. If anybody asks, a patient may be critical."

"Yes, doctor," she said, bewildered.

I knew what I would find when I got to their house, and I even knew where I would find it. I didn't waste my time with the inside of the house—instead, I headed straight for the rose garden in the back. Paul was sprawled on the stone path, pools of blood forming at the base of the rose bushes. I ran to the house to call the emergency room and get bandages, not waiting to find out whether I was too late.

* * *

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Paul's eyes fluttered open. He winced.

"Hi," I said quietly.

"You again."

"You thought you were rid of me for good this time, huh?"

He smiled gamely at my lame attempt of making a joke out of it.

"When did the Milton-Shattuck symptoms start?"

"About a week before you came up to the house. It's not too bad yet."

"Why didn't you tell me?"

"I thought you'd—I don't know what I thought. I was scared."

"I figured."

"I thought you'd think it was just that I was scared myself. But you already can see that Irena—"

"Paul. I know."

"Who else?"

"What?"

"Have you told. . . ?" He trailed off, but I knew what he meant.

"No. Chen doesn't know. And we've still got a pretty good chance on the funding for the project. Once we started dealing with Dennis Shakker's estate . . . anyway, I'm willing to go ahead with it."

"You mean it?"

"Yes. Definitely. I've even got the site picked out for the new facilities."

He closed his eyes. "Good. I was afraid this would end it."

"It almost came close. What were you thinking? We have things almost arranged. You can live with this."

"I wasn't thinking," he whispered. I had to lean forward to hear him. "I . . . it just started, and it was like I was on a feedback loop. And I knew what that place is like, where they make you keep Irena. I knew what it would be like to go there when I was that sensitive. I wouldn't last like she does. I don't have any channel for it like she does."

"We'll make you one."

He grimaced. "I'll hold you to that."

"I know."

"How are you going to get this cleared with the powers that be?"

"We've got a pretty strong case. Everyone knows we have no cure—there are people trying anything, in illegal clinics in Mexico. I'm a practicing physician with a documented case. Well, two, but we won't tell them that yet."

"Where is Irena? Does she—did you tell her?"

"Yes. I'm sorry if that was the wrong thing, but I thought she deserved to know. We're working on getting her a pass to come visit you. Definitely by tomorrow."

"Tomorrow," he murmured, and slipped back into sleep.

I watched him for a moment before slipping out quietly. There were two police officers waiting in the hall. They stood up when I came out. "Can I help you?" I asked them.

"We're looking into Mr. Ducasse's situation," one of them said carefully. "Is there anything you can tell us about the incident?"

My mind was on the new facility, so I said, "Huh?"

The second officer said, "We're trying to figure out whether Mr. Ducasse was attacked or whether it was an attempted suicide. Can you tell us anything about that? Did he tell you anything?"

I thought fast. If they knew it was an attempted suicide, Paul might not get to make Irena's medical decisions any more. Much less his own. If anyone got wind of it, he'd be declared *non compos mentis*, and that'd be that. "I'm almost sure he was attacked," I said firmly. "He said he didn't remember much of what happened, but Paul is not the sort of man to take his own life. And if he did try, he'd succeed."

The first officer nodded. They asked me a few more questions about Paul and his history, but I could tell we were pretty well safe on that count.

By the time I got home that night, I was ready to collapse. Every time I finished seeing a patient and would sit down to breathe a moment, I kept getting calls from the Shakker family and our other funding agencies, trying to de-

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termine the particulars of our plans. We had a dozen patients lined up, and all of their families were waiting impatiently for the report I was supposed to be sending out at the end of that month, before they moved in and started figuring out what they wanted their surroundings to be like.

They were not the only ones getting reports.

"I've received some disturbing rumors about your conduct, Jean." Chen was looming over me, trying to make me feel like a kid in trouble. Her voice was soft and a little threatening.

"I can't imagine why."

"Don't play with me. You know exactly what I'm talking about."

"That I have funding for alternate research? Why should that be disturbing?" I tried to keep the anger from my voice. I failed utterly. I had not been so angry in a long time.

"Your 'alternate research' is going to kill people. We already know it doesn't work. What the hell is wrong with you? Are you a doctor or—or—I don't even *know* what you are. Gratuitous cruelty in the name of science. Does that even have a name? I can think of a few, I suppose, but I'm hoping you'll come to your senses."

"Is that how you've known me?" I leaned across her desk. "Come on, Diane. You've been my boss for years. Have you ever known me to harm a patient? Sometimes a little pain is necessary for healing."

"There is no such thing as a little pain for a Milton-Shattuck patient," she gritted. "And no such thing as healing."

I sighed. "Look. These people are willing to try to find a better way. What you've got now is just keeping them controlled. I want to help them live."

"And I want them to all go into spontaneous remission, but I don't believe that it's going to happen. And waving my hands over their heads and chanting isn't going to make it so, either."

"I am neither waving nor chanting."

"Better living through interior decorating? Jean. You're a scientist."

"Yes. I am. And as a scientist, I am willing to use what works for the patient, rather than dictate what will work based on my own beliefs."

"I have had more experience with Milton-Shattuck patients than—"

"Than anyone but Oliver Milton. I know. But not with Irena Ducasse. She was happily living at home—*happily*, Diane—before you interfered. I had the same reaction you did to her unusual state. But I stuck around to learn the facts. To see how she actually was experiencing her environment. You just treated her like a number."

"I can see there won't be any arguing this with you."

"If I'm wrong, I will come to you and abjectly apologize."

"I doubt that somehow."

"Well, I doubt that I'll be wrong, so it's a safe offer."

Her jaw twitched. "You can be right or wrong somewhere else. You don't work here any more."

That was no surprise. I turned to leave.

"And I'll be discussing this with the Council on Ethical and Judicial Affairs. I am not convinced that you're still competent to practice medicine. I don't know what's happened to you, Jean, but I won't have it affecting my patients. Or anyone else's, if I can help it."

I was proud of how calm I sounded. "I'm sorry you feel the need to do that."

"So am I."

I had expected it. I knew it was what needed to happen; I would have been resigning to work full-time in the new research facility as soon as we got it established, anyway. It was just harsh to be leaving, especially on such short notice. I wandered through the halls back to my office in a daze. Regan was waiting with a phone message, but I interrupted her.

"I'm not going to be returning to

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work here, Regan," I said.

"Why not?"

"Chen fired me. She doesn't like the new project."

Regan folded her arms and snorted. "She can't always get what she likes."

"She can here."

"Not from me."

"You're not quitting over this, are you?" I demanded. "You don't have to do that."

"Of course I don't," she said. "But I want to. It's not right. And I think there'll be another research facility in the area looking for nurses any day now. Experienced nurses."

I almost cried. "I think so. We could use you. You know how to work with Milton-Shattuck patients. You're gentle."

"They need me," she said simply. What she didn't say was that I needed her there, too. Regan had been my mainstay, my right hand, for my entire medical career. You don't give something like that up easily. It was good not to have to.

The new house didn't open for patients for another week. For the first time since college, I had time off that was truly mine. I didn't have anything familiar waiting for me, but I had all the preparation I needed, I thought at first. And then I realized I didn't.

I went walking in the hills, the way I usually do. But I also went to the symphony. I spent the morning at a bookstore, just looking through rows and rows of magazines I'd never heard of. I took long baths and got a massage and went to a pet store just to pet the puppies.

When I got to the new house, I was energized and ready. Which was a good thing. The work left me drained every night. I spent some of my days doing microscope work with the biochemist we'd hired, trying to dampen the electrical pulses from the amplified nerves back to normal levels.

We still didn't know if the Milton-Shattuck survivors would have the intended results as they aged—most of them were still fairly young, too young for their senses to deteriorate, and the older ones were either dead or comatose.

But the rest of our research was trying to fix that. I would take a small item—a swath of fabric, a little bag of food items, a disc or a bottle of perfume or even a movie—and work my way down the hall. The patients would all react to what I'd brought, and I'd try again with something else.

That makes it sound like a calm and controlled experiment. Of course, it was anything but. Early on, we discovered that Dennis Shakker could not stand the noise of a rustling paper bag. The feel of a plastic one was anathema to Elizabeth Carrell. And so on. Irena loved music, but she also enjoyed the shine of the discs themselves.

At first, they were like toddlers. They screamed and howled or went completely catatonic whenever I brought things they didn't like. I felt like the Wicked Witch of the West. I felt like everything Chen said was right. In the middle of the first week, I got notice that the CEJA had scheduled a hearing based on Chen's complaints.

And then Dennis Shakker went a whole day without mentioning Joe, or Randy, or any of the other mysterious figures who inhabited his brain. Irena did her first new painting since she left the hospital. Things started to look up.

As long as I had some evidence, the CEJA hearing in Denver was going to be a breeze.

Chen was waiting outside the seminar room when I got there. "You can't mean to pursue this," she said. "I'm surprised you haven't dropped this research program already."

"I can't believe *you* haven't dropped the charges," I said. "We've got patients with us. Milton-Shattuck patients right over there in that little closed room, and they're doing fine. Out in public, Diane. They can only handle it for a brief time, but they can handle it."

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She turned and walked away, heading into the courtroom without another word. Paul just missed her when he came out of the conference room.

"What was that about?" he asked.

"I don't know," I said. "She really thinks we have no case. I don't know what she's going to try to pull, but I don't like it."

The room where the CEJA was holding the hearing was set up almost like a courtroom: there was a long table at the front for the council's use, and the rest of the room was set up in chairs facing it. I sat down on one side of the front row with Paul next to me and a few of our sponsors next to him. The patients' family members took the second row. Chen was on the other side of the row from us, along with some other doctors I had seen at conferences.

The council members filed in. There were five of them—two women and three men, dressed in tailored business wear. One of them spoke softly to call the proceedings to order, and Chen got to lodge her complaint. Then it was my turn.

"You all know the characteristic treatment of a Milton-Shattuck patient," I began. "As the disease progresses and sensory signals get more and more amplified, typically the patients spend their time in a special ward. Often they are restrained. Some are comatose. They cannot leave their special environments without having a major incident. They wear different clothing, designed to feel more like their own skin. They eat bland and tasteless mush.

"My patients aren't like that. They aren't normal—I want to emphasize that. I haven't found a cure, not yet. But they are able to deal with a limited range of everyday activities. None are comatose. None need restraint. And all were in need of round-the-clock supervision and restraint when they were under the normal treatment regimen."

I turned to Dennis Shakker's brother, Andrew. "Will you bring them in?"

We had brought three, but they looked very alone in the room. They were wide-eyed and childlike; I was used to that. Each of them clutched a favorite object. Irena stroked a stuffed plush bear Paul had found for her. Elizabeth took quick whiffs of a vial of powdered rosemary. Dennis had brought a polished wooden box.

"Hello," said Irena. She was generally the most social, having had the least exposure to destructive treatment. "Dr. Derner says you want to ask us questions."

"Yes," said one of the men on the council slowly. "How do you feel?"

Irena shrugged. It looked almost like a tic. "Okay," she said. "Too many people here—too many different smells. And that painting is awful, out in the lobby. I don't want to look at it ever again. It'll make me sick. I want to go home."

Elizabeth sniffed at her rosemary.

"Do you feel sick at home?" the same man asked her.

Dennis rolled his eyes extravagantly. "That's the point, stupid. It's *home*. Home doesn't hurt."

Chen spoke up. "Not even when Dr. Derner brings you new things?"

"New things hurt," said Elizabeth softly, and I sighed.

"Do they?" Chen asked, a little louder. "Does Dr. Derner hurt you with new things often?"

They looked at each other. "We get new things every day," said Irena. "Some of them hurt. Some don't. We don't have so many as when we started."

"Every day Dr. Derner hurts you?" Chen pressed.

"Not so loud," whispered Elizabeth.

"Not every day," said Irena. "Every other, maybe."

"And do you ever feel better than this? Or is it pain or nothing?"

"Stop it, stop it!" said Elizabeth. "Too *loud!*"

"Sometimes it's good," said Irena defiantly. "Not always hurting. Not like you. You're hurting Elizabeth right now.

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You're hurting me." She cast a glance over her shoulder at Paul. I looked, briefly; his eyes were closed, and his lips were moving.

"If you can't stand someone talking to you, how can you possibly be cured?" Chen's voice was spiraling up the register. "I would submit to my colleagues that the essential problems of the disease remain, with the only 'treatment' difference being that Jean Derner subjects her patients to pain regularly, for no curative reason!"

"Shut up!" said Irena. "You're too loud. Too high."

Elizabeth was holding her head.

"I think it's time for the patients to adjourn," said one of the women on the council. "I think they've had enough stimulation, and we've seen their capabilities." I couldn't read on her face whether they'd seen enough to make my case, but I let Andrew Shakker take the patients out again, turning Irena carefully away from the ugly painting.

"They are more fully functional than any Milton-Shattuck patients I've ever seen," said the man who had questioned them.

Chen blinked. "They were in pain. As they are at least—"

"Because you kept badgering them!" said another of the men. "This is research, Dr. Chen. It's new and it's scary and it might not work. But it's research. These patients looked like they were making progress. You looked like you were impeding it. If I were you, I'd watch that tendency."

It was all over then. The council conferred briefly and rendered a decision that I had not, in fact, violated any code of professional ethics. They said, in fact, that easing patient suffering in the long-term was quite a valued part of the medical profession in the past, present, and future. Which I knew, but I was glad they saw it that way.

When I turned to Paul to exult together, I saw that he had passed out, propped up in his chair.

* * *

I had bought a bag of pomegranates at the farmer's market. The man who ran the place had gotten used to seeing me in the mornings and had set them aside for me. It took Regan and I awhile to prepare them for the patients to eat, and we had stolen a few of the little round seeds ourselves.

Dennis wrinkled up his face. "No, no, no!" He pushed the bowl away, and I only barely stopped it from spilling.

"What's wrong with them?" I asked. "Too sweet?"

"Too crunchy! Too red! I don't know. Take them to Irena. They're like her."

"Crunchy and red?"

He scowled. "You know what I mean."

"Have some sweet tea," I told him. "It'll get the taste right out."

Dennis reached for the pitcher, and I closed the door behind me. His door thumped. Irena's was only a click. Everything mattered, everything we could find. I handed Irena three pomegranate seeds. She crunched them thoughtfully. Her face lit up.

"You can have more," I said. "Dennis, Xiao-mei, and Angela hate them, and Elizabeth wouldn't even taste them once she touched them. There's no way we'll use up all of them."

She took two more handfuls. "They're lovely."

"Well, I'm glad someone likes them. What are you doing today?"

She made a face. "Garden plans."

Paul came through the door that separated their rooms, startling when he saw me. "Oh, hello, Jean. We've just about got the fences figured out."

"I don't like fences," said Irena.

"Hedges, then." They beamed at each other. I slipped out to try to coax their next-door neighbor into trying a pomegranate seed or maybe venturing out into Irena and Paul's budding gardens.■

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Tongue-Tied

Grey Rollins

Speak softly and carry a big stick?

A certain amount of paranoia comes naturally in a big city. An attitude that would get you branded as deviant and antisocial in rural Iowa is a cold fact of survival in a metropolis. There are bad people out there who want to do bad things to you. You stay out of the places where the bad people go unless you have a pressing reason to be there.

Martin and I had a reason to be there.

Pete Sims, homicide, had called in the wee hours. The jangling of the phone rattled Martin's brain. Given the size of his brain, the same effect could have been had by dropping a pin. Had it been his gonads, the bells of the Nôtre Dame Cathedral would have been hard pressed to do the job.

An hour later, we were standing in an alley in a part of town that the mayor, the Chamber of Commerce, and the police department would prefer didn't exist. We had two hours to go before the first rays of dawn crawled over the horizon. Pete was looking at Martin, and Martin was looking at me. I was looking at the body.

"Well, Victor, what do you think?" Martin asked.

"I think he's dead." I answered.

Pete grunted. "Do you think you could be a little more specific?"

"I think he's *very* dead." I padded over to the body sprawled on the asphalt, choosing my footing carefully so as not to cut my feet. It wasn't easy; the alley was paved with broken glass. Using my tongue, I gestured towards the man's chest. "There's an awful lot of blood."

"I was thinking that it might be something from off-world," Pete offered. "That's why I called you guys in. You're my resident experts on aliens."

"I don't think he was bitten, if that's what you mean," I said. "This is going to be some sort of weapon."

"It's not like anything I've ever seen," Martin admitted.

"Me, either," added Pete. "It's like all the blood on the inside of his chest suddenly soaked though the skin."

I unraveled another foot or so of tongue and unbuttoned the victim's shirt front. Pulling the material aside, I began probing with the tip of my tongue.

"Um, Martin, you said this was a John Doe, right? Perhaps if nobody claims the body in a week or two—"

"*Victor!* Don't even *think* about it," Martin scolded. "You can't eat the corpse! I don't care if the body is *never* claimed, you can't have it."

"Too late," I confessed. "I already thunk the thought."

For some strange reason, humans waste their dead by burying them. My species are scavengers, thoroughly adapted to decomposing food; the culi-

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nary embodiment of the dictum "Waste not, want not."

As for using my tongue to examine the corpse . . . my arms are tiny, vestigial appendages with scarcely enough strength to lift a telephone. My tongue is my primary sense organ, prehensile, and much stronger than my hands. I have an advantage over humans in that I can speak clearly without having to worry about what my tongue is doing. My words are emitted by a tympanum.

"*Huzzzzz!*" I protested, snatching my tongue away from the dead man's chest. "There's something sharp in there!" I curled the tip of my tongue around in front of my eye, examining the damage.

"I'd go cross-eyed if I tried that," Martin noted to Pete, watching me.

"That's because you've got two eyes," I retorted. "Superior beings, like myself, only have one, so as not to get confused trying to sort out two different views of the same thing. Saves brain power for other uses . . . like thinking."

Martin doffed an imaginary hat. "Well, Your Shortness, those of us cursed with binocular vision will have to muddle through."

"Shortness? *Shortness?* I'll have you know I'm exactly tall enough to reach from the soles of my feet to the tip of my top, and all points in between. You're just jealous."

"Jealous of what? Name one thing you can do that I can't."

And . . . my mind went blank. There wasn't a thing I could think of that Martin—at over six feet, double my height—couldn't do at least as well, if not better. I subsided into uneasy grumbling, promising myself that I'd get even with him at the earliest opportunity.

We stayed for a bit longer, but there was little more we could do. All that remained were the remains, so to speak. There weren't any clues other than the pinprick I'd received from his chest, and that might be no more than a sliver of bone. I was content to leave that for the coroner to decide.

Martin yawned as we were exiting the alley. "I'm looking forward to getting back to bed."

"I could, perhaps, 'elp you with that, *chéri*," came a soft, seductive voice from the shadows to our right. The French accent was thick enough to cut with a knife.

Martin looked, then looked again. "Oh, uh . . . hi."

The woman who stepped out of the shadows had more curves than the Mississippi. She cocked her head, eyeing Martin speculatively. "You were saying something about bed, I believe."

"I . . . uh . . . um . . ." Martin's jaw was working, but his brain wasn't. The only reason he didn't topple over was that his mind was spinning. He'd unwittingly reinvented the gyroscope and it was the only thing helping him keep his balance. It's interesting to see a grown man regress to a preverbal state; the years fall away as you watch. I take it as proof that time travel is possible, if not exactly controllable.

"Excuse him, Miss. He's just tired," I put in, hoping to save face for Martin.

She noticed me for the first time. "*Ohhh! Mon Dieu!* You are so *cute!*" She reached down and stroked my skin gently. "Oh, and so soft!"

Martin, astonished, watched as she fondled my top. "Uh . . . Victor," he began.

"Oh, be quiet, it feels good," I told him.

Her eyes opened wide. "It does? *Bien.* Well, 'ow about I try . . . this?"

And I swear in that moment I discovered how a dog must feel when someone hits that magic spot on their rib cage and their hind leg starts kicking uncontrollably. I began trembling all over in a most undignified way.

"What you two are doing is illegal in six counties in Alabama," Martin noted dryly.

"He is *adorable!*" the woman said, giving the word a French spin. "He looks like a big—"

And a horn sounded, not six feet

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away, obscuring what she said—probably for the better. Given what I suspected her profession to be, I wasn't sure I wanted to know what comparison sprang to her mind.

"Banana?" Martin suggested, eyeing her décolletage, of which there was plenty.

"Coco!" Pete bellowed through the open window of the patrol car. "What are you doing to Victor?"

"Victor? Is that 'is name? But 'e is so cute, Officer Sims! I just want to—"

Pete held up a hand. "Spare me the details, Coco. I'd really rather not know. Just quit messing with his head."

"My *top!*" I insisted, finally finding my voice now that Coco had quit rubbing the magic spot.

"Who said anything about 'ead?" she protested.

Pete sighed. "Please, Coco, just be a good girl and let Victor go."

"But—" she began.

"Coco, there's a dead man in that alley. He was murdered. The murderer is still at large. This is not a good night for you to be on the street."

"*Homme mort?*"

Pete nodded grimly. "Now, can I give you a ride, dear? Let's get you someplace safe."

Involuntarily, she glanced towards the far end of the alley to where the forensics crew were drawing chalk lines around the body and taking pictures. "Ride? Yes, Officer Sims, I will take a ride. Dead, I do not want to be."

"Good girl," he said. "Slide in."

As Coco opened the door to the police cruiser, she gave my top one last caress. "But 'ow about Victor and 'is big friend?"

"They've got their own car. They'll be okay. Right, boys?"

Martin gave Pete a thumbs-up sign. "Just fine."

"*Au revoir*, Victor. We will meet again, I think," Coco said. Then she closed the door and Pete pulled out into the empty street.

Martin and I walked through the crisp night air back to his car. Fortunately, it wasn't far away.

Scoundrel that he is, Martin couldn't leave well enough alone. "Ohhh, 'e is so cute!" he mimicked in a high-pitched sing-song. "*Adorable!*"

Inspiration struck.

"Martin?"

"Yes, Victor?"

"Remember when you asked for a good reason to be short earlier?"

"Yep," he said, unlocking the car door and lifting me in.

"Our friend Coco . . . would you say that she was wearing a rather short skirt?"

He sighed happily, nodding as he wrapped me in the seat belt to keep me from falling over.

"My line of sight was entirely different from yours," was all I said, leaving him to work out sundry geometries and perspectives.

He was remarkably quiet on the drive home.

The office was quiet the next morning . . . if you could ignore Martin's snoring, that is. He'd fallen asleep ten minutes after we got in. The arched black lettering on the door spells out Martin Crofts, Private Investigator. What it doesn't say is that I'm the brains and he's the brawn. Every so often I go on a campaign to get him to add my name to the door. After a week or two of nagging, he promises to get someone to put my name up there, but that's usually just about the time we run out of money. Food and rent are more important than names on doors.

It's just my vanity. Nothing important.

Had it been anyone other than Martin, I'd make more of an issue about it, but he's my best friend. Or my best human friend, I should say. Which is where Wanne comes into the picture. Wanne is my para, and I am her ortho, and nothing but death should us part. Only . . . we *were* parted. Martin's uncle kid-

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napped me and brought me back to Earth. Martin inherited me when his uncle died, and we can sum things up by saying that it's been a long, *long* time since I've seen Wanne.

Suddenly there's this human female named Coco who in some mysterious way knows exactly what to do to stir up some very uncomfortable conflicts. I needed to consider issues like fidelity to Wanne, and whether it was moral, ethical, or even practical to think about a human the way I was thinking about Coco.

The phone rang.

There was a terrible, raucous screech—the kind of sound a pterodactyl might utter after suffering a paper cut—followed by a dull thud. Knowing exactly what had happened, I padded from the reception room into Martin's office, picking up the extension on Martin's desk.

Before I could say anything, Pete said, "The body last night? It's full of needles."

"A drug addict?"

"No, I mean literally. Somebody gave him a liberal dose of large, high-velocity buckytubes, end-on. Each one cut a core out of his chest on the way through. That's why there was so much blood. "

Martin moaned piteously.

"What was *that?* " Pete demanded.

"Martin's sprawled on the floor, looking like Tokyo after Godzilla dropped by."

"On the *floor?* What happened?"

"He was asleep when the phone rang, and fell off his chair. I'm not sure whether to call for an ambulance or a hearse."

Pete chuckled. "Say the word 'money,' and see what happens."

"Money," I said, slowly and distinctly.

Martin's eye nearest me popped open. "Money?" he inquired hopefully.

"Pliable presidential pictures printed on paper," I assured him. "Legal tender for all debts public and private."

Martin grimaced as he rubbed the back of his head. "Let's leave out the word 'tender,' if you don't mind. I think I knocked my noggin on the way down." He groaned as he got to his feet, then leaned over painfully and pulled his office chair upright. The pterodactyl scream repeated as the ancient springs returned to their upright position. "Who is that, anyway?"

"It's Pete. He says the guy we looked at last night was shot with buckytubes."

"What the hell is a buckytube?"

"You know what a buckyball is, right?"

He prodded the back of his head, wincing. "Yeah, that's those little spheres made out of linked carbon atoms."

"Right. buckytubes are—"

"Lemme guess . . . little straws made out of carbon."

"Right."

"I can't believe no one heard anything," Martin said. "After all, it's a shotgun."

Pete had heard him. "A shotgun? How does he figure that?"

I relayed Pete's question.

"Well . . . because they're firing bucky shot," Martin responded, an overly innocent expression on his face.

As I gave Martin my best approximation of a scowl, Pete snorted in my ear, then added, "By the way, Victor, Coco wants to see you again."

"Me?"

"Yeah, she says you remind her of a big—"

Martin picked that moment to lean back in his chair, causing the springs to screech horribly.

"Uh, well, I'm flattered . . . I guess. But, I'm not sure how Coco—"

Martin's head snapped around. "*What?* Is Pete trying to corrupt you? Gimme that phone, Victor!" he demanded.

I handed the phone over.

"*Yeeech!* " Martin screamed, dropping the phone on the floor. "Victor! You slimed the phone! How many times do I have to tell you not to hold it with your

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tongue?" He was staring at his hand with an expression not unlike the way a cat looks at its paw after unintentionally stepping in a mud puddle.

I waddled over to pick up the phone. "Pete?" I asked. "Are you okay?"

"*Hmmmph!* Other than being deaf in one ear, I'm fine. Why don't you two drop by here later. Hopefully my hearing will have recovered by then."

I told him we would and hung up.

Martin glared at me. "As long as I live, I'll never get used to you slobbering all over everything."

"They say dog saliva is an antiseptic," I noted.

"Last I heard, dogs had four paws and barked. All you've got is two little stumps and a tongue like an overgrown worm."

"*Stumps?*" I stuck out a leg, turning it this way and that to admire its shapely form. In an aggrieved tone of voice, I informed him, "I'll have you know my legs are not 'stumps.' They're finely turned examples of what all the best creatures are using for locomotion these days."

"Yeah, and they're not even as long as my hand," Martin noted.

True, in a purely factual sense—which is why it stung. "You're just jealous," I grumped, before turning and stomping out.

Martin and I caught up with Pete just after lunch. Pete had been thinking about it, and was of the opinion that the next logical step would be to see if Coco could ID the body. However, Coco was likely to be skittish about talking to anyone wearing a uniform.

"And you know what that means," Pete said.

"What?" Martin said.

"You fellows need to go troll the streets, looking for her."

"*Us?*" Martin squawked.

Pete nodded. "You're not cops." He chuckled, eyeing me, and I knew what was coming. "Besides . . . she likes Victor."

Martin looked me over skeptically. "Damned if I can see why."

"My natural good looks," I responded.

Martin's eyebrows crinkled. "Well, come along, stud muffin. If you're such hot property, let's use you to bait the hook."

I padded along next to Martin, visiting parts of town catering to the instant gratification of desire. For lack of anything more substantive to contribute, I began playing a tune. My tympanum puts all but the highest-fidelity speakers to shame, and as long as I draw breath, Miles Davis shall not be forgotten.

After a few minutes, Martin looked down at me. "What's that you're playing?"

"The name of the tune's *Doxy*," I answered, adding my voice to the music effortlessly.

He gave me a skeptical look, as though I'd just made up the word. "*Doxy?*" he inquired.

"Let's just say that I'm setting the scene—call it 'Coco's theme.'"

The women we passed were smiling and waving, knowing two gentlemen out on the town when they saw them. I waved back jauntily, causing no end of amusement among the ladies.

Martin chuckled.

"What?" I asked.

"Look at you. Acting like some kind of movie star, or something."

"So what's so funny about that?" I demanded.

"Well, I keep trying to envision you in a tux and tie, looking all suave and debonair—"

"And?"

"And all I get is a penguin with a three-foot tongue."

So I kicked him, and the next time a girl leaning against a lamp post gave us a speculative eye, I flickered a discrete length of my tongue at her, enjoying the wide-eyed look I got in response.

"*Victor!*" Martin hissed out of the side of his mouth. "Stop that! You're going to

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get us arrested."

"For what? I'm an alien species, doing what comes naturally."

"Okay, let's go back and ask that girl if she thought what you were suggesting was a natural act."

I chuckled at his discomfort. Anything to liven up the tedium. Looking for *a* woman wasn't the problem. Looking for a *particular* woman was getting tiresome. We asked several times if anyone knew Coco, but if they did, they weren't telling.

Hours passed and Martin was flagging. He was on the verge of calling it a night when we turned a corner that happened to place us on the street where we'd first met Coco. We had purposefully avoided it, thinking that it would be the last place that we'd find her, knowing that murder had been committed in the area.

But she was standing there, looking straight at us as though she'd been waiting for us. She pushed off of the store front where she was leaning and peered up into Martin's eyes. "A girl could get very sad waiting for you," she complained.

"Martin's not the kind to be tied down," I explained.

"But you, on the other hand," she replied, "are the sort who is completely loyal. I can see it in your eye. You are a romantic."

This left me somewhat at a loss for a response. Coco sidestepped behind Martin, neatly switching sides. Now, she was between us as we began walking, her left arm linked through Martin's, her other hand gently caressing my top.

"So . . . I am wondering. Are you searching me out for me, or are you searching me out for, perhaps, another purpose?"

After Martin explained our dilemma, she sighed. "So you only want me for my mind. And I was hoping you wanted more. Silly me."

Martin hesitated, not wanting to encourage her. "Well . . . "

"*Alors!* But, of course! Work first, play later. Let us go see Officer Sims and his dead man. Perhaps I can be of use to you twice in the same evening."

Martin, being accustomed to having more say in the matter, was clearly flustered. For my part, I had to admit that my early life in a rain forest had hardly prepared me for a human woman with an agenda.

But . . . life is for learning.

It took Coco about three seconds to ID the John Doe. She inhaled sharply, nodded, then turned on her heel and walked out before anyone could stop her. Martin caught my eye, then nodded for me to go after her.

Ridiculous, on the face of it. If Coco decided to run, I'd have about as much chance of keeping up as a snail would with an Olympic sprinter. My full run is barely equal to a human's fast walk. But as it turned out, I nearly bumped into her as I went out the door. She was standing under the single light outside the entrance, her head back as she tried to force the tears to stop streaming down her face.

I'm not built such that anyone can cry on my shoulder. I can't even do a very good job of patting someone's hand in sympathy. All I had were words, and I had to choose them very carefully.

"Coco?" I said softly.

She took a deep, trembling breath before responding. "Yes, Victor." Her face was still turned up towards the night sky.

"Can I help?"

She looked down to where I stood by her side. "I don't suppose you're very good at holding people, are you?"

"There's always a first time."

She kneeled and put her arms around me. I put mine around her, patting her back gently, the way I'd seen people do in the movies. It seemed a useless gesture, but yet, at the same time, it was the right thing to do. I can't explain it. Perhaps I've been on Earth too long.

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Her tears continued, hot as they touched my skin, but cooling quickly as they ran down my side. It tickled insanely, but I didn't think it was the right time to mention it.

"Not just someone you knew?" I prompted. "Someone you cared for?"

She nodded, her hair sliding against my skin. "My brother."

It seemed one of those moments when one should say something like, "My God," but religion is a uniquely human affliction, and I had no other words at my disposal. "I'm sorry," I said.

It seemed to be enough. A fresh wave of tears began, just as Martin's face appeared around the edge of the door. He seemed surprised to find us in each others' arms. I waved him back inside. He nodded and closed the door quietly.

The brief break in the rhythm of my patting caught Coco's attention. She inhaled and tried to master her emotions. "I suppose that your friend Martin and Officer Sims would like to know a few things."

Humans nod, rather than say anything at such a crucial moment, but I am not so flexible. "I'm afraid so," I said as softly as I could.

She sighed. "Very well. Let us begin."

She stood, reached down to take my hand, and we went inside.

Her brother's name was David.

Her real name was Diane. She was no more French than the Midwestern corn belt from whence she'd come, but she'd made such a habit of the accent that she couldn't drop it entirely, and it kept flickering in and out.

"I came here to be an actress," she said. "If that didn't work, I thought maybe I could model."

"You're pretty enough," I assured her.

She gave me a strained smile. "Thank you, Victor. You are extremely gallant." She shrugged. "Actually, I did model for a while. The acting never came through, though."

She paused for a few moments, gathering her courage before going on. "I won't bother with the specifics, but I did some things, thinking that they'd lead to getting a small part in a film. I've always been, shall we say, flirty . . . I didn't really mind. I thought it would all work out in the end. The acting never materialized, and I discovered that, uh . . . flirting with the wrong people can get you into a situation where you're . . . compromised." She took a deep breath. "They said they'd tell my parents."

"And you didn't want your family to know," Pete said.

She nodded. "A little bit was okay. Like I said, I've always looked at these things in a way that didn't sit well with the Baptist mentality back home. But it got to be more than a little and they used that as a lever to make it even more still. I didn't mind so much for me, but my parents . . . oh, they would just die, if they knew."

"And your brother?" Pete prompted.

"He knew—or figured it out, anyway. He came to visit last Thursday, put two and two together, and got really angry. Not with me—he knows how I am—but with the people who put me in a corner such that it was no longer my choice."

Pete had a pencil ready. "We'll need names, of course."

Diane nodded, her gaze dropping to the floor. "Of course. You realize they'll try to kill me."

"Then we'll stop them," Martin said, in such a matter of fact tone that she believed him instantly.

Pete ran his hand through the wreckage of what had once been a full head of hair. "Coco—uh, Diane, how would you feel about staying with Martin and Victor?"

"Not protective custody?"

"That's exactly what they'd expect, right? So we send you home with a down-on-his-luck private eye and his alien partner. If they don't know where you are, they can't hurt you."

Martin was still trying to decide whether he'd been insulted, so I spoke

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up. "We'd be glad to take her in, Pete." I turned to her. "The final decision's yours, though."

She sighed. "They killed my brother. I won't say that I'm not afraid, but I need to do *something*."

"Diane," Pete said gently, "your brother was killed by a very unusual weapon. Did you ever hear anyone speak of a gun that fired very small tubes?"

She shook her heard. "I was never threatened with violence—just blackmail."

"Who was blackmailing you?" Pete asked.

"The only one I ever saw was Doug, but he worked for . . . you're going to think I'm making this up."

Pete shook his head. "No, go ahead."

"Gargoyle."

"Gargoyle?" Pete repeated. "Surely, he must have had a real name."

Diane shrugged. "That's all I ever heard him called."

Pete shook his head. "That's a new one on me. Okay, fellas, I reckon it's time to take Diane back to your place. Keep her there until—"

"No," Diane said flatly.

Pete's eyebrow raised. "Huh?"

"Sooner or later, they'll contact me."

"Diane, it's too dangerous," Pete told her.

But she was not to be dissuaded. She wore Pete's objections down, one by one, until he had only his stubbornness to fall back on, and that she countered with her own.

She placed her hand on my top. "Victor will not allow me to come to any harm. Neither will Martin."

"But—" Pete began.

"And neither will you. You will be watching. If anything happens, you will be there to protect me."

Pete sighed, and said, "All right."

He didn't look as though he felt too good about it.

Martin and I hid out in his car. For once, the car's disreputable appearance was an asset; no one gave it a second glance. Pete had come with us, but was hiding in an alley up the street, wrapped in a huge, scruffy denim jacket that had been floating around the police station so long no one remembered where it had come from.

Diane, back in persona as Coco, was standing against the wall where we had first met her. She made no attempt to solicit business, and her lack of eye contact kept most men from approaching. Those who did try to strike up a conversation were directed to another young lady who had staked out a corner two blocks further down.

Martin shook his head and muttered quietly, "That girl's got more guts than most Marines I've known. Her brother died a stone's throw from where she's standing, and she's—"

"*Sbbh!*" I hissed. "Look . . . a car just pulled up."

The car was new, blue, and expensive. A mid-line Mercedes electric sedan. Diane cocked her head, studying the car, then pushed off of the wall, ambling over to the front passenger side window.

Just as she bent to look through the window, the rear door sprang open and a man leaped out. The front door opened from inside, and the man bundled her in before she could even scream. He then slammed the door, jumped back into the rear seat and the car was away before he could even get his door closed.

Martin gaped. "*What?* They weren't supposed to take her!"

Pete came pounding down the sidewalk as Martin tried to crank the car. It turned, spluttered, and died. Again he tried, just as Pete jerked open the rear door. The motor didn't even twitch. Pete cursed, backed up and gave the car a resounding kick. Thus put on notice, the car caught immediately. Pete jumped in and Martin swerved into the street, pulling a fast U-turn, to the alarm and annoyance of several drivers who

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happened to be under the impression that they had the right-of-way. Horns blared in our wake.

Martin, in spite of his scarcely concealed desire to charge the Mercedes and try to force it off the road, managed to restrain himself. He followed until the Mercedes slowed, then turned into a small office park. After pulling into a parking lot across the way, Martin slipped me out of the seat belt and the three of us quietly snuck across the street towards the building where Diane had been taken. Pete held up his hand for us to stay put, then edged one eye around the frame of the glass front door.

"You might as well come in," came a perfectly conversational voice from a speaker by the door. "The door's unlocked."

Pete cursed, belatedly noticing the small camera in a corner of the brickwork aimed at the door. He pulled the door open and gestured us in.

A thin man came from the back of the building. "Your guns, please," he said politely. After he'd collected Pete's gun—Martin wasn't carrying one—he stood regarding Pete's flashlight for a moment before holding out his hand. Pete gave it up grudgingly, as its heft would have made a decent club, but no doubt the thin man had come to the same realization. Finally satisfied, the man said, "This way, please."

Like so many others, the building was impersonal. I didn't realize that the institutionalized sameness of the surroundings was lulling me into a sense of complacency until our guide opened a door and gestured us through.

My sense of reality lurched.

The room was dark and quite large, lit only by a few very dim red lights. It was silent, virtually an anechoic chamber. Off to the right was a bank of screens. They were at an angle to me, but I could see that at least one was of the view outside. There was a man sitting in front of the bank of monitors, wearing a headset. He paid no attention to us.

"It's the girl you're after, I suppose?" came a voice from the gloom to our left.

Martin jumped at the sound of the voice, but recovered quickly. "Yeah."

"Would I also be correct in assuming that you have a small interest in the matter of her dead brother?"

"The thought had crossed our minds," Pete responded.

There was a protracted silence before the voice spoke again. "There is a saying—be careful what you ask for, you might just get it. Not all is as it seems."

"It seldom is," Pete answered.

"How true . . . how true."

There was something odd about the voice. It was too perfect. Too well modulated. It was the voice of a statesman or a stage thespian. There was a hint of a British accent, but also perhaps a bit of a Caribbean lilt, with a bit of . . . well, of nearly everything, once you listened for it.

Another silence followed before the voice spoke again. "Bring the girl. Let's get this over with."

The thin man left via a side door, letting in a brief moment of light. I'd been waiting for that. What I saw nearly took my breath away.

"You're Gargoyle, aren't you?" I said.

"Hmmm, yes, little one. An apt name, is it not?"

Now that I knew what to look for, I could just make out a few faint details. Even though I can see better in the darkness than humans, I was able to see very little.

"You're accustomed to life underground," I ventured.

"And this you know by. . . ?"

"The darkness in here is one clue. That could simply indicate a nocturnal creature. But your body gives off very little heat, and it's cool and quiet in here. Too much like a cavern to be a coincidence."

"Well done, little one."

"Victor," Martin whispered, "what's over there? I can't see a thing."

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"You don't want to know," I assured him.

Just then, the side door opened, and the man returned with Diane, shoving her in ahead of him. She stumbled in the sudden darkness.

"The very one," Gargoyle said.

"I know you," Diane said. "I've heard your voice before."

"Well, yes, I suppose you have. But to say that you *know* me? That might be going a little too far."

"So what's the game, Gargoyle?" Pete demanded. "What is it that you want?"

"A little of everything. A *lot* of everything, actually. I have far-reaching interests, and the time and wherewithal to indulge my curiosity."

"A lot of words for so little answer," Pete snapped.

You could almost feel anger gathering on the other side of the room. I was beginning to get intimations of mortality.

"Cheeky, aren't you?" Gargoyle said at last. "I understand that you've seen the mortal remains of Diane's late brother."

"We have," Pete growled.

"Consider yourselves warned. I have only so much time to devote to you this evening, and you're wasting it."

"So what do you want?" Pete asked, for the second time.

"Several things. I wanted you here. And here you are. Diane makes such excellent bait, don't you agree? After all, you were using her to try to lure me out. Instead, I turned your game, and brought you in. Not that it was difficult, mind you. You were really quite obvious."

"You said several things," Pete growled. "What else?"

"Well, there's Diane herself. A pity her brother couldn't be here. He, like your small companion there, understood things. In two short days, he figured out more than she could if it was pasted on a billboard by the freeway."

I tried my hand at drawing Gargoyle out. "The prostitution, the blackmail that you're almost certainly using on other people besides Diane . . . what do you want with the money?"

"Excellent. Excellent. What do you think, little one?"

I was getting weary of being called "little one," but was determined not to let Gargoyle goad me into anger. "You don't care about the money. You're using it to pay humans. *They* want the money."

"Turn it around. What is worthwhile to me? To one of my species?"

"I wouldn't know. I'm not familiar with your species or your wants," I told him.

"Oh," Gargoyle said, sounding rather deflated. "I guess that spoils the fun, then, doesn't it? Very well, I'll give you a hint. A single word. And the word is . . . politics."

"Influence," Pete guessed.

"Good, good." Gargoyle sounded pleased. "So the humans are able to help the little one after all. Influence, then. But what would I do with influence?"

I took a wild shot. "You're peddling your influence off-world."

"Splendid! Well done, little one. I am what you might call a lobbyist. A power broker. I am beholden to no one, but others are beholden to me. This allows me to play the game you know as politics with wonderful detachment. It's all just a larger version of having manipulated you here this evening. The same thing can be done with politicians. Give them what they want or what they think they need, and you have them. Then, when the time is right, you can extract from them certain small favors. It's this balance—and use of power—that my species finds simply irresistible."

Diane spoke for the first time. "You mean that's all it is to you . . . a game?" she gasped. "You killed my brother . . . you manipulated me . . . for nothing more than fun?"

She had come to terms with the idea that someone might have maneuvered her into her current circumstances for profit, but the idea that it had been done

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purely as sport was more than she was willing to accept.

"Oh yes, it's quite stimulating. Or, at least it is when it's more challenging. You were no more trouble than your three friends, here."

Diane shrieked and hurled herself across the room towards Gargoyle. There was a whiplash crack, and suddenly Diane was skidding across the floor, visible because the lights had suddenly come up several notches. She was spread-eagled, spinning as she slid towards Martin's feet. He tried to step out of the way, but tripped and fell as one of her arms entangled his legs.

Pete tore his eyes from them to look up at Gargoyle. His gasp was audible. There was a padded cup over a meter across, filled to the brim with the stuff of nightmares. A squat, conical head with small, filmy eyes such as you see in creatures whose eyes have atrophied from disuse. A bony beak, serrated around the edge, protruded from under the armored cap. It looked large enough to swallow a dog whole. Three longish tentacles sprang from the short, wrinkled, cylindrical body beneath the mouth, plated with scales at first, then gradually going to oily, brownish-red skin at the end, where the tip bifurcated into smaller foot-long tentacles, each tipped with a hooked talon fully six inches in length.

I decided this had gone on long enough. I started edging slowly towards Gargoyle. "What is your species called?" I asked.

"You couldn't pronounce it," Gargoyle sneered.

"Try me."

The resulting noise was something like the cry of a bluebird being crushed under a jackboot. I reproduced it with ease.

"Impressive, little one. I see that you must speak with a tympanum, as I do."

"It works for me," I said. I was now within reach of Gargoyle's tentacles, but he was also within my reach. I was watching his talons carefully.

"Thinking of starting something, little one?" Gargoyle mocked. He waved a weapon about the size and shape of a flare gun. "Think carefully."

So much for the element of surprise.

I flicked my tongue at the tentacle holding the gun. Frogs have been doing this sort of thing for millions of years, but it wasn't something I'd practiced. I managed to snare his tentacle just behind the gun. He immediately tried to jerk out of my grasp, but only succeeded in firing the gun—a quiet popping sound, not unlike a cork leaving a bottle. There was a dry rustle as the buckytubes spent themselves against the ceiling.

Pete came rushing to my aid, pinning another tentacle to the floor. Martin tried the same tactic, but was repulsed. In our struggles, we tipped the cup that Gargoyle was sitting in, spilling him onto the floor. He made a frantic grab for a control on the edge of the bowl, plunging the room into darkness.

Now he was in his element.

I heard a grunt of pain at my side as Pete was thrown back against the wall to my left. That left me wrestling Gargoyle, in complete darkness, with two of his tentacles free.

I released Gargoyle and padded away as softly and quickly as I could, hoping that he couldn't hear where I went. I was running out of options, fast. Gargoyle was armed and accustomed to darkness. I had a limited ability to see into the infrared, but it wasn't enough to see a cool-bodied creature clearly. Martin and Pete were completely out of their element. The only way they'd be able to do battle would be if they blundered into Gargoyle blindly. Even though we had Gargoyle outnumbered, the odds were not in our favor.

"Boss! Where are you?" the technician called.

I'd forgotten about him and the slender man. The scales were tipped further against us than I'd thought.

I called out, mimicking Gargoyle's

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voice, "Shoot them, you fool!"

"Where are they?" the slender man's voice cried out.

"You idiot, he's using my voice!" Gargoyle shouted.

I upped the ante, making strangled noises. "Fire! Quickly! Shoot the one who's imitating me—"

And the thin man's gun barked.

My bandages itched.

The veterinarian at the zoo was the only doctor who'd ever had the nerve to look at me, though it had always been for relatively minor things in the past. A bullet wound in a unique alien species filled him with terror. He didn't know whether antibiotics would work, whether anesthetics would deaden my pain, or even whether any vital organs had been hit. Never had I been more painfully aware that I was the only one of my species on Earth. No one knows anything about my physiology, and I paid a dear price for that lack; I endured the doctor's surgery without anesthesia. That should have earned me a medal.

Martin was there, Pete was there, Coco was there—they were all as supportive as one could wish for. Coco held my hand as I *buzzed* continuously for twenty minutes as the vet went in after the bullet. He got it. He peered around, decided that there wasn't any evidence of serious organ damage, then closed me up.

It was all I could do to keep from picking at the bandage with my tongue. I had come to the conclusion that I was allergic to the adhesives in the tape he'd used to bind my wound. Nothing could itch that badly, otherwise.

Coco lightly stroked my side to distract me from the itching. "Victor, you were so brave to fight Gargoyle," she said.

"I didn't really fight him . . . I just kinda arm-wrestled with him for a few minutes," I protested.

"But then you won," she persisted.

"Not the way I'd hoped," I grumbled.

"I thought that you were pretty clever, imitating Gargoyle's voice like that," Pete put in.

"It didn't work," I groused.

Pete shrugged equably. "Perhaps not, but then you got him right between the ears."

When the thin man shot me, I screamed. The way Martin told it, it was about twenty times louder than a jet taking off. The humans were stunned, but Gargoyle went catatonic, or something very close to it. After someone found a light switch, Pete simply walked over and took the gun out of his flaccid tentacles. Believing him dead, his human lackeys gave up without a fight.

Records found on site had led to the resignation of several political personages of note, and the grave embarrassment of a number of others. Gargoyle had been pulling strings for legislation favorable to various alien species for years. All simply so he could revel in being a puppet master.

Gargoyle was incarcerated at the zoo for the time being. The vet was proceeding slowly but carefully in trying to pull him out of his zombielike state. In retrospect, the clues were there all along—the deathly silence of his room, and the fact that he'd admitted to being from a subterranean environment where surely the only noises were small and quiet. Still . . . who'd have thought that Gargoyle's hearing was *that* sensitive?

"At least it's over," I said.

Pete turned to Coco. "Have you thought about what you might do?"

She looked sad. "I'll have to go home for David's funeral, but then I think I'll come back."

Pete looked surprised. "Really?"

She shrugged. "I'd like to get to know this town on my terms. It may sound crazy, but I like it here. I'd like to start fresh, get an ordinary job, and see what I can make of my life."

Martin nodded approvingly and I re-

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membered what he'd said about her being braver than Marines he'd known. "Then what?" he asked.

Something passed across her face, a fleeting expression comprised of equal parts hope and shyness. "Well . . . maybe I could make some friends. That would be a good start."

Martin wrote his phone number down on a scrap of paper and gave it to her. "If you think that Victor and I could be of any assistance, please call."

She kissed him on the cheek, then turned to me. "And you, Victor? Would you mind if I called?"

"I'd be honored," I assured her.

She stroked my top, then tickled me a bit in that mysterious way she'd discovered. "You are so *cute!*" she said, lapsing for a moment back into her French accent.

Temporarily unable to speak, I concentrated on forcing my muscles to quit trembling.

"What's wrong, Victor?" Martin teased. "Tongue-tied?"

Pete snorted. "With a tongue like his, unraveling it would be like trying to undo the Gordian knot."

Mentally, I vowed revenge on them both, but putting it into practice would have to wait until I regained control of my body. In the meantime, I was considering what it might mean to have Coco around more often.

And how I'd explain it to Wanne. . . . ■

(EDITOR'S NOTE: Earlier "Victor" stories include "To Victor Go The Spoils" [June 1990], "Victor Victorious" [December 1990], "The Victor" [January 1991], "Spoiled Rotten" [April 1993], "From The Jaws Of Defeat" [July 1994], "Garbage In, Garbage Out" [December 1995], and "Food For Thought" [November 1999].)

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DECRYPTION AND QUANTUM COMPUTING: SEVEN QUBITS AND COUNTING

A completely new kind of computer is rising on the technology horizon, and it has just reached a significant milestone. A quantum computer, a device first suggested decades ago by Richard Feynman and others, has been constructed by Isaac Chuang and his coworkers at IBM's Almaden Research Center in California. The prototype quantum computer uses entangled nuclear spins for storage and has a capacity of seven "qubits," a term that will be discussed below. Using a quantum-computing algorithm developed by AT&T's Peter Schor in 1995, this quantum computer has factored the number 15 into its prime-factors, 3 and 5. Admittedly, factoring 15 perhaps doesn't sound like much of an accomplishment, but it represents the most complex computation that has ever been performed with a quantum computer. It requires some explanation to appreciate what has been accomplished so far and where it will lead.

A conventional computer has a memory in which bits of information are stored in definite binary states of 1or 0, and a processor that operates on this stored information. For example, the memory may contain two numbers stored in binary representation and a program specifying the locations of these numbers and calling for them to be multiplied together and the result stored. With the execution of the program by the processor, the numbers are fetched, multiplied, and their product in binary representation stored in the memory.

A quantum computer differs from this computing scheme is one important way: the definite-state memory 0-or-1 bits in the conventional computer are replaced by indefinite qubits (short for *quantum bits*.) The qubits are *possible* states in a quantum system and may be indefinite. For example, all fluorine-19 nuclei have a nuclear spin of $^1/_2$ unit of angular momentum. This spin may point either "up," i.e., parallel the flux lines of an external magnetic field, or "down," i.e., opposite the direction of the lines of flux. It is a peculiarity of the rules of quantum mechanics that no other spin directions, (e.g., "sideways") are allowed for $^1/_2$ unit spins. The spin of a fluorine-19 nucleus might be in an up state, a down state, or a mixture of the two, depending on the conditions of preparation. If the spin direction is used, as in the IBM quantum computer, to represent a binary qubit, then that qubit may be 1, 0, or a mixture of both.

The up and down spin states have slightly different energies, so a slight addition or subtraction of energy using megahertz radio waves can force the nuclear spins into one orientation or the other. However, it is also possible to prepare the spin orientation of the nucleus in an indefinite state that is 50 percent up and 50 percent down. There are also techniques for measuring (or reading out) the spin state acting as a qubit. If the qubit in an indefinite 50-50 state is read out, the quantum rules require it to randomly "collapse" into either a 1 or a 0 state, with an equal chance of each outcome.

Of course, a quantum computer

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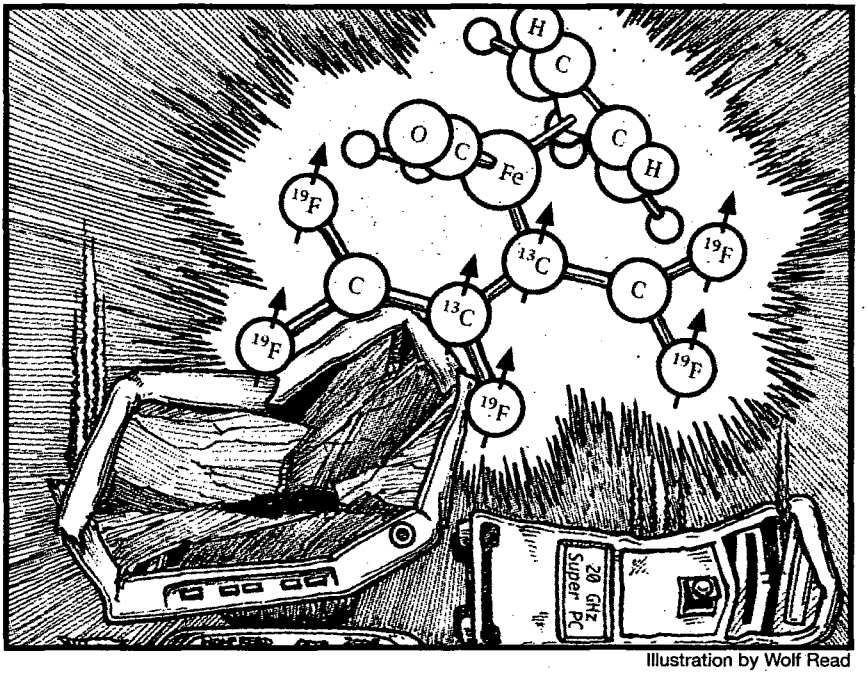

Illustration by Wolf Read

needs more than just qubits for its operation. The qubits must be well enough insulated from the random scrambling effects of random environmental noise (called *decoherence*) that the coherent state of the quantum system is preserved for at least for long enough to set up a calculation, perform it, and read out the results. It must have the ability to initialize any qubit in a specified state, and to measure the state of a specific qubit. It must have "universal quantum gates," logical elements capable of arranging any desired logical relationship between the states of qubits. It must also have a processor capable of interlinking quantum gates to establish rules and boundary conditions for their interrelationships. In a quantum computation, the arrangement of quantum gates connects the qubits in a logical pattern, according to a program or algorithm, and after an interval, the qubits assigned to the result are read out. If this is done properly, the quantum computer can be made to perform calculations in a way that is qualitatively different from calculations performed on a conventional computer.

The powerful capability of a quantum computer is its use in computational problems that require searches over a large number of possibilities in order to find those that satisfy certain criteria. An example is a search over all prime numbers to find a pair that produces a specified number, when that number is very large.

A conventional computer must explore all the combinations of alternatives, one set at a time, in such a search. This may be computationally "hard" if the number of alternatives is very large. A quantum computer with enough qubits to hold the problem, on the other hand, can search the alternatives in parallel, all at the same time, and reach the problem's solution in a much faster time.

The new quantum computer constructed by IBM uses the nuclear spins of seven atoms that are part of a molecule with the iron-based chemical composition $H_5C_{11}O_2F_5Fe$. Two of the 11 carbon atoms in the molecule are carbon

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isotope 13 and all of the fluorine atoms are fluorine isotope 19. All of the other nonhydrogen atoms in the molecule have even isotope numbers and no nuclear spins. For the quantum computation, a sample of about 10^{18} of these molecules is placed in a magnetic field and manipulated using the techniques of nuclear magnetic resonance (NMR), so that the spins function as qubits. NMR is an excellent technology for implementing quantum computing because nuclear spins are well isolated from environmental noise. Therefore, the decoherence time, i.e., the time after which quantum coherence is lost due to random interactions with the environment, is very long. The NMR fields of the quantum computer are manipulated so that Schor's prime factor algorithm is performed and the number 15 is factored into the primes 3 and 5.

To factor a larger number, a system with more than seven qubits would be required. Things would get interesting when about 24 qubits were available for such computations. With 36 qubits or so, a quantum computer should quickly perform computations that would require a time equal to the age of the Universe on a conventional computer. Unfortunately, such a qubit scale-up is difficult, because the IBM device is near a hard technology limit of NMR quantum computing. For its operation, all the qubits must be in the same molecule, and molecules with more than seven or so spins that can be used as qubits do not seem to be feasible.

Fortunately, there are alternative technologies for quantum computing that promise to be more scaleable than the NMR technique. In particular, the technologies of electron spin orientation in quantum dots, nuclear spin orientation of single atom impurities in semiconductors, and manipulation of magnetic flux quanta in superconductors all show promise of providing a basis for scalable quantum computers. There is intensive work on quantum computing in these area, but difficult decoherence problems must be overcome before they become competitive with NMR.

What actually goes on in a quantum computer to produce their amazing capabilities? The British mathematician David Deutsch, who has contributed to the development of the theory of quantum computing, likes to invoke the Everett-Wheeler interpretation of quantum mechanics (see my column "Other Universes II" in the November 1984 *Analog*) to describe this quantum computing process. Deutsch asserts that the quantum wave function describing the qubits splits among many parallel universes, so that the quantum computer calculations proceed in many parallel universes at the same time. Finally, the answer is found in one of these universes and is transmitted to all the others, which effectively recollapse into one universe. This is certainly a colorful way of describing quantum computing, but it is very noneconomical, in the sense that the assertion is in danger of having its throat cut by Occam's Razor.

As the originator of the transactional interpretation of quantum mechanics (see "The Quantum Handshake" in the November 1986 *Analog*,) I prefer to visualize the process in a different way. The programming of the quantum computer that sets up the problem has created a set of conditions such that the quantum mechanical wave function can only form a final transaction and collapse by solving the problem (e.g., finding the prime factors of an input number). The advanced and retarded waves, describing all the possible qubit states of the system, race through the computer, seeking the ultimate multinode quantum handshake that solves the problem. This process happens very fast, because the propagation time of advanced waves is negative. The net result is that the solution transaction forms, the wave function collapses into the solution state, and the result is read out. This, I think, provides a simple, eco-

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nomical, and insightful view of what goes on in a quantum computer.

How might a quantum computer be put to use? Consider the widely used information protection scheme called RSA public-key encryption, as embodied in the widely distributed PGP encryption software. Suppose, for example, that Alice wants to use the RSA procedure to send a private message to Bob. Bob has previously posted his public encryption key (a long string of 1s and 0s) in some public database. Alice retrieves Bob's public key from the Internet, and she uses it on her conventional computer running a widely distributed public-key encryption program (e.g., the PGP program) to encrypt her private message to Bob.

Once this is done, the message cannot be decoded, except by Bob, even by someone who has both Bob's public key and Alice's encryption program. Now Bob receives Alice's encrypted message by email and decrypts it using his second, private, key and the same program. The privacy of the message is ensured because only Bob has the private key, and he has never revealed it to anyone else, not even Alice.

The RSA encryption algorithm depends critically on the fact that it is easy to multiply two large prime numbers together and obtain their product, but it is computationally "hard" to factor the resulting product back into the original primes, if they are not known. The main part of the public encryption key used by Bob is, in fact, a large number that is the product of two primes, and his private decryption key is one of the prime factors of that public key.

With a conventional computer, it might require many years of computer time to factor the large number in Bob's public key. However, with a quantum computer, the large number, at least in principal, can be factored very rapidly and the message broken. Thus, the RSA encryption procedure is based on the assumption of the difficulty of prime factoring, and quantum computers threaten to invalidate that assumption.

It is not surprising that the National Security Agency, the code-breaking and electronic surveillance arm of the U.S. federal government, has for many years opposed the wide distribution of strong encryption schemes such as the RSA algorithm. It has also arranged for federal laws that block the distribution of certain forms of strong encryption outside the USA and Canada. It is perhaps more surprising that the NSA is currently one of the principal funding sources for research into quantum computing. Big Brother would like to read your email, even when it is RSA encrypted.

Beyond code breaking, there are other uses for quantum computers. They should make possible super-fast searches of large databases, for example. Moreover, in physics there are many problems involving the simulation of quantum systems that can only be poorly approximated by calculations on conventional computers. With a computer that had a good "quantum coprocessor," such physical systems could be simulated much more directly, in ways that are not presently feasible. In my own area of physics research, ultrarelativistic heavy ion physics, we badly need this capability. We limp along without it, making approximations that are only pale shadows of the quantum reality. I would like a good quantum computer on my desk, right now! ■

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Forget Me Not

Amy Bechtel

What we want is not necessarily what we need.

The lobby of the Escabero Building, in the heart of the city of Chicago on Earth, was opulent beyond anything Dr. Samuel Marsh had ever seen or imagined. A holographic fountain dazzled his eye; the walls were lined with brilliantly lit aquaria of live fish. The carpet was a deep lush blue, and was immaculate. The color of the carpet reminded Samuel of Indigo's oceans, as viewed from space, and he felt a twinge of homesickness. He peered at the swirling, brightly-colored fish displayed in the aquaria. Their beauty might once have delighted him, but now they made him feel vaguely uneasy. A vivid blue one swam to the front of the tank and stared at him, and Samuel hastily looked away, returning his gaze to the fountain.

A young woman suddenly appeared at his elbow, her trim body clad in a business suit as immaculate as the carpet. "May I be of assistance, sir?" she asked. She glanced doubtfully at his worn trousers and striped shirt, as if she thought he might have wandered into the wrong building by mistake.

Samuel drew himself up, trying to look professional. "I have an appointment," he said. "With Mrs. Helena Garcia of NSI."

"Of course, sir," the young woman said, bringing out a pocket display. "If you would place your hand against the screen, sir?"

Obediently, Samuel did so. The screen flashed green, then displayed his photograph along with a rather large amount of text. The woman studied it for a moment, punched a few keys, and then smiled at him. "If you will follow me, Dr. Marsh, I'll escort you to Mrs. Garcia's office."

"Thank you," Samuel said, and followed her as she led the way between the aquaria and into an elevator. The elevator had a black marble floor and white marble walls with gold trim. All of the surfaces looked as if they had just been polished. Samuel could see his reflection in the wall; he stared at it a moment, then looked away. The elevator doors opened and his guide led him down a carpeted hall to an office with the letters NSI stenciled in gold on the door. She ushered him into the office, showed him to a seat, and left him there.

Samuel gazed slowly around the of-

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fice. This was a much more comfortable-looking space, lined with wood paneling and bookshelves. The desk was equipped with a high-powered built-in computer, and was adorned with a spray of flowers in a graceful glass vase. Forget-me-nots, Samuel realized, and wondered uncomfortably what the significance of these particular blooms might be. Why would anyone at NSI, New Slate Incorporated, prominently display a vase of forget-me-nots? Samuel, like everyone else who visited this office, had come here to forget.

"Good afternoon, Dr. Marsh."

Samuel had not heard anyone enter, but a woman now stood in front of him. She was an older woman, silver-haired, wearing a simple, conservative dress, a light cardigan, and low-heeled shoes. Old-fashioned reading glasses hung about her neck from a delicate silver chain. Samuel stumbled awkwardly to his feet. "Mrs. Garcia," he said.

"Please, sit down," Mrs. Garcia said, moving to take a seat behind the desk. "No need to stand on ceremony. We have some rather rigid rules downstairs, but here in my office I like to be a bit more informal."

Samuel nervously lowered himself back into his chair. "Thank you, Mrs. Garcia," he said.

Mrs. Garcia smiled kindly at him, perched her glasses on her nose, and peered at her computer screen. "Now then," she said. "I see that you live on Indigo. This is a new colony, is it not? Somewhat off the beaten path of civilization?"

Samuel nodded. Indigo was about as far off the beaten path as one could get. It was a frontier colony, small and poor. It was not an easy place to get to, and it was not on the way to anywhere else.

"Yet you were born on Topaz, in the city of Saint Leona. A beautiful city; I've been there. What made you decide to move to Indigo?"

"I wanted to be a doctor," Samuel explained. "But I came from a poor family. I couldn't afford to go to college, much less medical school. Indigo provided a scholarship."

"I see. And you were the only recipient."

"Indigo is a subsistence colony. It took years of saving for them to provide the scholarship I received."

"And there are conditions, I see." Mrs. Garcia gazed intently at her computer screen.

"Yes. I agreed to practice medicine on Indigo for a minimum of fifteen years, once I graduated." Samuel looked at her uncertainly, wondering why she was asking questions when the answers were on the screen before her.

As if hearing his thought, Mrs. Garcia leaned back in her chair and looked directly at him. "We have access to many facts about your past, as you know. You sent us a great deal of the data yourself. But in order to determine if we can help you, I need to know your personal impressions, your point of view. Now, how long has it been since you graduated from medical school?"

"Five years."

"Leaving another ten yet to serve. How do you like living on Indigo?"

"I love it there. I did from the beginning. I'd always wanted to live someplace small and quiet. Someplace where you could really get to know your patients, and be part of their lives. My classmates kept telling me I'd hate living someplace so primitive and rural, but they were wrong."

"I see." Mrs. Garcia gave him an unreadable look. "And how do you like practicing medicine there?"

Samuel hesitated, not sure how to answer. His practice had become a nightmare, but once, not so long ago, it had been a dream come true. The residents of Indigo had welcomed him, had brought him into their hearts and homes. They would have welcomed any doctor, no doubt, after all the years of having to travel to Topaz to receive medical care, but he had developed a special

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rapport with his patients, with the community. "It was everything I ever wanted," he said at last. "Once."

It had been exhilarating, knowing that he was in a place where he could really make a difference. Certainly there were telemedicine connections, even on Indigo, but this was not much use without a doctor to do the hands-on examination, to know the patient well enough to get a good history, to do the immediate work on emergencies such as poisonings or trauma. Samuel had thought it would be stressful, being the only doctor on Indigo, and it was at times, but he always had backup and support from the teledoctors, so he was never truly alone.

"You felt fulfilled in your work," Mrs. Garcia observed.

"Yes." Samuel tried to remember what it had felt like, back then. "There was little Maddie Harris; she swallowed a whole bottle of her mother's heart medication when she was two. Such a cute little toddler, and I've gotten to watch her grow up—she's six now. And Sean Davison, he was out cutting zebra trees when his blade slipped. He cut open his arm and lacerated an artery, but it's healed beautifully and there's hardly a scar now."

"It sounds as if they would have died, had you not been there."

"Yes," Samuel said. "Most likely they would have. Mrs. Garcia, the people on Indigo need me. They—they trust me."

"These hardly seem things one would wish to forget."

"But I do," Samuel whispered. "I can't bear that they trust me, not any more. They shouldn't."

"Why shouldn't they?" Mrs. Garcia looked at him quizzically.

"Jessica Miller." An image of Jessica shot into his mind. Thirteen years old, bright and happy, jet-black hair in a long ponytail that bounced behind her when she moved. And she was always moving, had been ever since Samuel first saw her, back when she was nine; the minute she was through with school and chores, she could be found running through the fields with her friends, jumping chasms, climbing zebra trees. Samuel had tended her inevitable lacerations and scrapes, had treated an allergic reaction to a zoombug sting. Another image of Jessica wiped away everything else in his mind: his hand on her arm, giving her the injection; the startled look on her face as she felt the drug enter her system. Samuel closed his eyes, but the image would not go away.

"Tell me about Jessica," Mrs. Garcia said.

"She was thirteen," Samuel said, and could not think how to go on. "I've never told anyone," he said. "Not anyone at all."

Mrs. Garcia waited, silent. Samuel stared at the forget-me-nots on her desk, past them to a pair of framed photographs he had not noticed before. Children, a boy and a girl, smiling out at the camera. Jessica had smiled at him, and had asked how soon she would be able to go out climbing zebra trees again.

"She was out in the fields," he said at last, "and she was bitten by an ariel. They're reptiles, quite pretty ones really. Brilliant blue, with translucent wings and frills down their backs. They're usually harmless, not aggressive at all, but the females hide their nests quite well, you see, and they burrow under the soil, and if a person stumbles into a nest, the female will bite. The ariels lay their eggs year round, and I usually see three or four cases a year. Jessica had been taught what to do in such a situation. She moved away from the nest, called for help on her link, and lay down to wait. It's important not to move around too much, you see. Movement causes the toxins to spread through the body much more quickly.

"Jessica's father picked her up in his floater and brought her to the clinic. No one was terribly concerned, because she'd gotten to the clinic in plenty of

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time, and we have an antitoxin that is quite effective. The original colonists had it manufactured on Topaz, and even when they had no access to any other medical care, most of the victims survived. With the supportive medical care I could provide, and with prompt treatment, well—everybody survived. I had seen a number of cases by this time, and the treatment had become routine to me. I calculated Jessica's dose, drew it up, and gave it to her."

It had not seemed important, at the time, that Jessica had looked startled, that her eyes had widened. But no patient liked receiving injections, and Samuel had thought nothing of Jessica's reaction.

"I was certain she would be fine. I told her she'd be back in the zebra trees in a week's time, and she wanted to know why she couldn't go tomorrow. I went back to seeing my regular patients, and came back to check on her an hour or so later. I was completely surprised to find that she was worse. The bite was inflamed and painful, and the area around it was starting to go numb. I wasn't sure what was going on. I thought perhaps the bite had become infected, or that Jessica had had an allergic reaction to the antitoxin. I drew blood samples and set up a teleconference with the Saint Leona medical school, on Topaz. But they didn't know what was happening either. The ariel is unique to Indigo, and none of the doctors I consulted had ever seen a case. And Jessica was still getting worse."

Samuel fell silent, lost in the memory. Mrs. Garcia stirred, and asked, "Could you not have given Jessica more of the antitoxin?"

"No," Samuel said. His heart began to pound so hard he could scarcely hear himself speak. "No, I couldn't—the consulting doctors concurred, more antitoxin was not an option. The dose window on the antitoxin is very small. Giving Jessica a second dose would almost certainly have been lethal. I was terrified for a moment that I *had* mistakenly given her an overdose—perhaps I had entered her body mass incorrectly—but the dose I had given, 4.7 cc, was correct. The consulting doctors confirmed this. And we all remained baffled.

"I put Jessica on supportive care, and treated her symptoms as best as I could. By now other medical schools and hospitals had come online, but none of them had an answer either. The Deep Verde medical school suggested a new treatment that had been shown to protect the liver from certain toxins, but on Indigo we did not have this drug. A packet was sent out in a priority shipment, but this was only a gesture, since it would take days for it to arrive.

"Jessica continued to deteriorate through the night. Her parents kept vigil over her, and I did the same on the net, sending messages to every medical site I could find. It was all useless. No one could help.

"Around noon the next day, Jessica seemed more comfortable, and she said that she felt a little better. She asked for water, and talked rationally to her parents and to me. We all got terribly excited, because it seemed that the supportive care was going to work. Her blood levels stabilized. She asked for a vid, *The Legend of Black Star*. Her father hurried home to fetch the vid. I could see the hope, the relief, in her father's eyes, on her mother's face.

"But it didn't last. By the time her father returned, Jessica had crashed. Her blood values destabilized, then went off the charts. But she was a fighter. She lived for two more days."

Two more terrible days, while part of Samuel knew things were hopeless and part of him refused to give up. Jessica drifted in and out of consciousness. When she was awake and aware, she described a growing numbness, emanating from the site of the bite and spreading all over her body. But soon she lost all awareness, even when she was con-

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scious, and she did not seem to recognize her mother or father. Samuel could only hope that she did not feel much pain.

"After Jessica died, her parents thanked me for trying so hard, for not giving up. Her mother hugged me. They sent me a card, later."

Samuel stopped. He was coming close to it now, to the part that no one knew, that he had never told anyone. Mrs. Garcia said gently, "I understand why you would wish to forget Jessica's death. But I do not think we can help you. There are extensive records, no doubt, that you would be bound to come across, and it seems that you will wish to continue to interact with Jessica's parents. We could make you forget, yes, but you would only learn of her death again, and you would not understand why you could not remember. The incongruity would likely be debilitating for you.

"We could, perhaps, cause you to forget the details of what the child went through. Then the memory of her death might not be so devastating to you. This technique has worked for others. But in your case I wonder if simple counseling might not be a better choice."

"Counseling?" Samuel said blankly.

"Yes," Mrs. Garcia said. "You feel more than simple grief and loss over this child's death, do you not? You feel guilt. A terrible guilt."

Samuel swallowed. "Yes."

"Yet you did all that could be done. You gave the proper treatment, consulted with all the experts; you were there for Jessica and her family in their time of need. Not everyone can be saved. You should not need to feel such guilt."

"I didn't, at first," Samuel said. He found himself staring at the forget-me-nots, unable to meet Mrs. Garcia's gaze. "The postmortem showed the characteristic effects of ariel toxin. The antitoxin had been ineffective in Jessica's case. The experts said it was an idiosyncratic reaction, something completely off the charts. These happen, sometimes. They can't be predicted, and sometimes they can't be controlled. I knew that; I accepted that. I grieved for Jessica, and the pain of losing her was terrible, but I did not blame myself.

"Four months later, a farmer, Jeremy Flynn, was rushed to the clinic with an ariel bite. Ariel bites had once been routine to me, but it was nerve-wracking this time. Jeremy knew what had happened to Jessica, and he was frightened. I did my job: I stayed calm, though I was just as nervous as he was. I explained Jessica's idiosyncratic reaction, and how incredibly rare such things are. I made sure I was projecting confidence. Of course while I was doing it I was calculating and double-checking the dose, which came to 10.4 cc. I got the bottle of antitoxin and began to draw up the dose.

"There are 20 cc in each vial of antitoxin. I had used 4.7 cc on Jessica; 3.5 cc on little Cinda O'Donnel a month before that. I drew up the 10.4 cc for Jeremy. There were 6.1 cc left in the bottle. *And there shouldn't have been.* There should have been 1.4 cc left. There was exactly 4.7 cc too much."

Samuel had stood still in shock, clutching the bottle, his body turning to ice, his stomach to lead. Jessica's dose was still in the bottle. He had not given her the antitoxin. He had given her the wrong drug. In desperation he had checked his figures again, twice more, three times, ten times. Every calculation had come out the same, with 4.7 cc too much antitoxin in the bottle. Samuel's vision had blurred, and his hands had trembled so much he could barely hold on to his computer. Jeremy Flynn had watched him fearfully, had said, "It's going to happen to me too. Isn't it?"

"My reaction had scared Jeremy badly, but I somehow managed to pull myself together, to put on a false front. I tried to explain away my reaction by telling him I wasn't feeling well, that I was having stomach pains and nausea. Which I was, of course. He became concerned, and

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asked why I hadn't gone to Topaz for a checkup. I started talking about how difficult it was to find a doctor who would do relief on Indigo for even a few days, and I promised I'd go in for my checkup as soon as I found someone to cover for me. It was so strange listening to myself talking cheerfully to Jeremy, with some sort of automatic bedside manner. So strange, because I was dying inside."

Samuel fell silent, and Mrs. Garcia shared the silence for a time. Then she said, "Did Jeremy survive?"

"What? Oh, of course. Jeremy responded to the antitoxin very nicely, and was back working in the fields within a week. He's completely recovered, now. As he should be, and not like Jessica. The look in her eyes—she jumped, she was startled, when I gave her the injection. As if the solution stung, or burned. The antitoxin doesn't burn. Doesn't sting. The injector is painless. If I had been paying attention I would have realized I had given the wrong medication. But I wasn't paying attention! I saw the look on Jessica's face, and I disregarded it, and now I can't stop seeing that look. The way she jumped, the way her eyes widened. I can't stop seeing it."

He met Mrs. Garcia's eyes at last. Reflectively, she said, "You didn't tell Jessica's parents."

"No. I didn't. I don't know for what reason. They had accepted Jessica's death. They were grieving, but they were coming to terms with their loss. I truly did think it would be better for them if I kept my secret, that if I told them the truth I would only upset them terribly to no good end. But there was another reason."

"And that was?"

"I couldn't bear to admit what I had done," Samuel said, ashamed. He sat with his head down, feeling sick and drained. He felt no relief that he had unburdened himself of his secret; he felt, if anything, worse than before.

He listened dully to the soft click of Mrs. Garcia's computer keys. After a moment she said, "How long has it been since Jessica died?"

"Sixteen months, standard," Samuel said. "And three days."

"The memory has not faded."

"No. It just keeps getting stronger. It haunts me, night and day. And it's affecting my work, very badly." He straightened up, and forced himself to meet Mrs. Garcia's eyes again. "I'm the only doctor on Indigo, and I've lost my ability to do the job. I've become so paranoid that I'm essentially paralyzed. I find myself reading drug labels fifteen times before I draw up injections, and as soon as I've drawn a dose and put the bottle back on the shelf, I'm terrified that it's the wrong drug. I end up discarding the dose and drawing it again, over and over, as each time I start having doubts about what it is. I can't bring myself to make the simplest diagnosis without getting outside confirmation. And it's hurting my patients. Last month Sarah Malone came in with an allergic reaction to a zoombug sting, which is a very easy thing to treat, and by the time I'd consulted online and drawn up her medication and discarded it several times, her symptoms had become severe. She nearly died while I was trying to decide what to do.

"I don't want to forget Jessica's death. I understand the limitations of your procedures, and besides, it wouldn't be fair to Jessica. How could I put her death out of my mind? What I want to forget is the moment I realized her death was my fault."

Mrs. Garcia said, "And you wish to do this so that you can regain your confidence. So that you can again be an effective doctor for your community."

"Yes."

"This may be within our abilities. There are no written records of the error?"

"None."

"And no one else knows of it."

"No one."

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Mrs. Garcia adjusted her vase of forget-me-nots. Diffidently she said, "You realize that our services are quite time consuming, and are correspondingly expensive?"

"Yes. I can afford it."

"Yet you are from an impoverished world, and make no salary to speak of. Your family is also poor, and you needed Indigo's scholarship in order to afford to attend medical school. How is it that you have sufficient money to pay for our services?"

"It was an inheritance," Samuel said. "It came out of the blue. When I was a resident on Topaz, I had an elderly patient, Aaron Lasalle. I came to know him quite well. We both enjoyed playing chess, and we often got together for games. Then I moved out to Indigo, and lost touch with him. Two months ago I learned that he had died, and had named me as his beneficiary. It turned out that he was wealthy. I'd had no idea."

"So you came, unexpectedly, into a fortune."

"Yes."

"And you wish to use it to purchase a memory removal."

"Yes," Samuel said. "I thought it was a sign. Fate. I was so desperate to forget, but I could never even afford to come to Earth, much less pay for the services. Yet then, suddenly, I could."

Mrs. Garcia examined her computer screen. "Indeed," she said. "I see that you can. And you wish to do this so that you can regain your confidence. So you can again be an effective doctor for your colony. Because you are the only doctor they have."

"Yes."

"I see." Mrs. Garcia removed her glasses, letting them hang from their chain, and directed her gaze on Samuel. "Who is tending your patients on Indigo, while you are here on Earth?"

Samuel swallowed. "I hired a doctor from Topaz. At the salary I was able to offer, she agreed to work there temporarily."

"Invested properly," Mrs. Garcia said, "your inheritance could provide a long-term competitive salary. With this in mind, could you not convince your relief doctor to stay on Indigo?"

Samuel was silent for a long time. "I probably could," he said at last.

"Had you considered this option?"

"Yes!" Samuel cried out, anguished. "Yes, damn it, I considered it! I did the numbers. I could hire a good doctor and still have money left over. I know that."

Mrs. Garcia folded her arms on her desk. "Yet you are here."

"Yes," Samuel whispered. His brief moment of passion, of anger, was gone, and he felt lifeless, drained. "I'm here. What I told you before was true. I do want to get my confidence back, so that I can be a good doctor for my people again. I want that very much. But it is also true that I cannot bear to have this memory for even one more day."

"And you will not need to," Mrs. Garcia said, very gently. She rose to her feet and walked around the desk, blocking Samuel's view of the forget-me-nots. She held out a hand to him and said, "Come with me."

Back on Indigo, the summer days were long and peaceful, and Samuel went through his days well contented. The time spent in therapy on Earth had done him a world of good; he had regained balance and perspective in his life, and had come to terms with Jessica's death. He still thought of her wistfully, wishing she might have lived, but he no longer felt paralyzed by her death. He knew, with a certainty deep in his soul, that he had done all he could for her. An idiosyncratic reaction to medication was like a freak accident, unpredictable, uncontrollable. He had learned what he could from Jessica's death, and had moved on.

He was nervous, certainly, the next time he treated an ariel-bite victim. But the antitoxin treatment proceeded un-

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eventfully, and the patient went home within days, fully recovered. After Samuel had successfully treated two more ariel-bite victims, his confidence returned totally, and the last bits of nagging tension left his mind. Samuel wrote a note to Dr. Garcia, who had been in charge of his therapy on Earth, and thanked her profusely for turning his life back around. He remembered how depressed he had become, how paralyzed he had been in his job, but he could scarcely conceive, any longer, *why* he had felt that way. He sent the thank-you note, a personal card on paper, out on the next ship.

A year passed, and it was summer again when Celeste Aragon was brought to the clinic with an ariel bite. Her young husband Juan came with her, clutching their three-month-old baby and looking very frightened. Celeste, by contrast, seemed more annoyed than anything else.

"I can't believe I didn't see the nest," she said. "It was right in front of me, and I stepped right into it. That's what comes of not paying attention."

"Well, you're hardly the first one to do it," Samuel said, picking up his computer to calculate Celeste's antitoxin dosage. "Nor the last, I'll wager."

"The treatment's safe, isn't it?" Juan blurted out nervously. "I mean, I was remembering that poor child, Jessica Miller. She died of the treatment, didn't she?"

"She had an idiosyncratic reaction," Samuel explained. "It's extraordinarily rare. I've consulted with the experts, and they say the chances are astronomical against such a thing ever happening again."

Juan looked doubtful. "But if there's any chance it could be dangerous. . . ." His tension was palpable, and the baby began to cry.

"Honestly," Celeste said. "Here, Juan, give her to me." She took the baby in her arms and rocked it gently. "Juan, dear, the ariel bite itself is far more dangerous than the treatment. Isn't that so, Dr. Marsh?"

"Indeed it is. Without treatment, the ariel bite is usually fatal. With timely treatment, there is a nearly one hundred percent chance of complete recovery."

"See?" Celeste smiled up at Juan. "I think I prefer the odds that go along with treatment. I'm ready, Dr. Marsh."

Samuel gave the family a reassuring smile, reached for the antitoxin bottle, and drew up Celeste Aragon's dose. Juan took the baby, and Samuel gave Celeste the injection. Her eyes widened and she looked startled, as if the injection had burned, but Samuel did not think anything of it.

He put the bottle back on the shelf, hooked Celeste to the monitors, and cheerfully went off to see his next patient. ■

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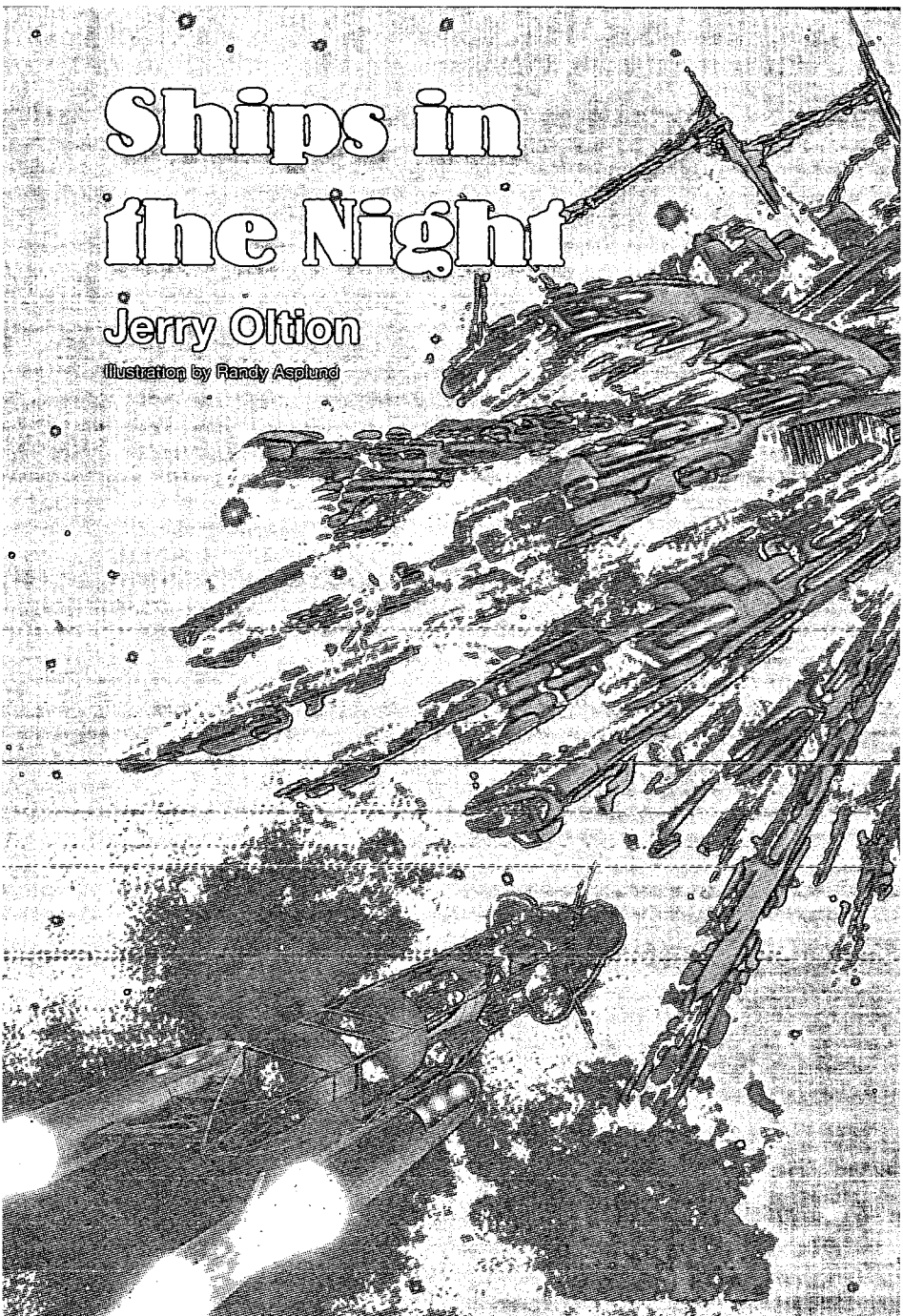
Ships in the Night

Jerry Oltion

Illustration by Randy Asplund



First contact for you may be far from it for the other guy—and your motives may be quite different, too.

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We followed him, of course. When an alien with a head like an artichoke comes aboard your ship in the middle of interstellar space, then flees in panic before you get a chance to even say "Hi," you follow. At least that's what we did. Of course we were desperate for company by that point, and would probably have chased after a brussels sprout or even a lima bean.

The women and I made the decision to change course, since Liam and Tilbey were busy battling to the death somewhere under the coffee table. We could have consulted them easily enough—even when we shrank to microscopic scale our ghost generators could keep us in touch—but none of us really wanted their input anyway. It was Tilbey who had scared the alien away in the first place, and nobody wanted to talk to Liam when he was in a murderous mood.

So we just played back the autopilot's log of our brief encounter with the alien ship, then fired the *Spook*'s engines at low thrust for a day to match its course. We didn't try to catch up. The alien had accelerated at hundreds of gravities, and the best we could do was about fifty, so we contented ourselves with plodding along at only 90 percent of lightspeed instead of his 99. He would get wherever he was going before we did, but we wouldn't be that far behind, and maybe he would have time to calm down before we got there.

I use "he" merely for convenience. The brief glimpse I got of him before he fled our haunted ship left me with no indication of gender or even species. Of course the only extraterrestrial life I had ever seen before had turned out to be as human as me, so I didn't have a whole lot of experience at identifying anything else.

When it came right down to it, I suppose Kylona, Yavetra, and Etinitu were more human than me, considering I'd been an artificially-generated ghost for years. So were they, temporarily, but they had bodies in storage to switch back into once we got somewhere where a body would be useful again. Tilbey, Liam, and I weren't so lucky. That's the problem with being the first to embrace a new technology; the people who wait a while get the improved model. Not that I was complaining. Being able to slip through normal matter or shrink to microbe size was worth the trade.

We were a bit disconcerted when we realized the alien ship wasn't heading for any of the nearby stars. Its course wasn't far from our original destination of Epsilon Indi, but a miss is as good as a billion miles over interstellar distances. We had no idea where it was going, but we weren't committed to any particular course ourselves, and we could always divert back to plan A if we got tired of the chase before we figured out its destination, so we allowed curiosity to lead us astray for a bit.

Things happen slowly over interstellar distances. The women and I amused ourselves doing what one man and three women find amusing, and Tilbey and Liam played hide and seek on a different scale, while our starship plowed on through the night, chasing a quarry we might not catch for years.

So we were a bit surprised a few days later when the autopilot alerted us to an object in our path only three weeks' flight time away. It would have been less than that, but we were going in almost the same direction, at almost the same velocity, so we were just coasting up on it at a couple thousand kilometers per hour. Had our alien visitor gotten over his fear of ghosts and returned for another look? That didn't seem likely. At the speed his ship had been capable of, he could have come back in an instant if he'd decided to. It seemed much more likely that this was his mothership we were approaching now, and the one we had seen had just come over to investigate us on their way past.

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The autopilot had found it with radar. I turned on our telescope to see if I could spot it visually, and was pleasantly surprised to find that I could. It looked more like a flying scrap heap than a spaceship, with extended booms and little nodules clumped haphazardly all over, but the *Spook* probably looked pretty strange to them, too. I studied it a while, trying to spot their engines and other stuff I knew had to be there somewhere, but nothing made any sense.

Then I looked at the scale bar at the bottom of the telescope screen and grew even more puzzled. I was seeing it at 1:1. No magnification at all. It couldn't be a million kilometers away if that was true. At that range, Earth's Moon would barely fill the 'scope. Yet some of the longer spars protruding from this thing stuck right off the screen.

There had to be something wrong with the telescope calibration. I refocused on Epsilon Indi and zoomed in and out a couple times, but it seemed to be working fine. Yet the radar obstinately said 998,240 kilometers. One of the two had to be lying.

Nothing artificial could be that big. The radar had to be wrong. Which meant the alien ship was a lot closer than we thought. And we were closing at a couple thousand kilometers per hour.

"Oh shit," I whispered when I figured it out. "Evasive action! Computer, veer off right now!"

"We are in no immediate danger," it replied.

"Look outside!" I yelled. "That ship can't be more than a couple of klicks away!"

"It is 998,236 kilometers distant. We are in no danger."

I hate artificial intelligence programs. They're like instant coffee: no matter how much you refine the process, you can never quite achieve the real thing. "Command override," I said. "We are in danger of collision. Now get us the hell out of that thing's path!"

"Very well."

Thruster lights glowed on the control board, but I couldn't feel any acceleration. I looked at the gee meter and saw it registering .001, the smallest increment it could measure. Of course: the autopilot still thought it had three weeks until we got there, so it saw no point in wasting fuel on a high-gee burn.

"You stupid silicon sack of shit!" I yelled at it. "Full pow—"

"No!" Kylona shouted, even though she, Yavetra, and Etinitu were all cringing as if we were about to strike. Then she said, "Full power without magnetic confinement would toss us out into space. Besides, the radar's right. It takes almost six seconds for the pulses to bounce back. The alien is really that far away."

She had a good point. At fifty gees, our simulated bodies would slip right through the decks unless we crawled into our magnetic acceleration cages first, and if we had time for that, then we weren't in the danger I thought we were.

I looked at the telescope screen again. 1:1 scale. Just to make sure, I said, "Coupling constant 20 percent" and stuck my head out through the wall beside the control console. In space, with nothing between my eyes and the alien ship, I looked for verification. I didn't have the light amplification ability the telescope did, but I didn't need it. The alien ship gave off plenty of light of its own. And it looked like I could throw a rock and hit it from here.

But I watched it for a good thirty seconds and it grew no larger. If we were as close as we looked to be, we would have hit it by now. I pulled my head back inside, increased my coupling constant back to my usual 75 percent, and said, "Okay, you're right. Next question: do we really want to approach a starship the size of North America?"

"What's North America?" Yavetra asked.

She and Kylona and Etinitu were from

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Alpha Centauri, from a planet Tilbey, Liam, and I had named Islandia because it had no continents. "Never mind," I said. "You get the idea. That thing's huge."

She laughed. "We have a saying where we come from. 'Size doesn't matter.'"

"Sure it doesn't." I looked at them, three milky white nudes, like animated Renaissance statues carved by a great master. Some of the games we had played after Tilbey had tweaked our ghost generators to allow us to change our body size belied Yavetra's smug statement; but a gentleman doesn't discuss such matters, so I didn't either. I just said, "We're going to be dust motes rattling around in that thing." That had been a fun way to increase our effective living space in our own ship, but I didn't relish the idea of repeating the experience somewhere else.

Etinitu said, "Maybe Kylona and Tilbey could fix it so we could get bigger as well as smaller."

They were our resident electronics experts. I looked to Kylona, and she said, "The bigger we get, the more energy it takes. We could probably boost our size, but only at the expense of our coupling constant. And it's a square-cube relationship, so twice the size would require eight times the energy, or give us one-eighth the solidity. At three times our normal size, we'd just be faint patches of fog."

"That ship is thousands of times the size of the *Spook*," I said. "A factor of three won't make a bit of difference."

"See?" Yavetra said. "Size doesn't matter."

I know when I'm beat. So I just held out my hands and said, "Okay, okay. We'll go check it out just as we are. But if everyone on board that thing is as scared of ghosts as their scout was, we may wish we hadn't. On their own ship they might not just run away."

"You're such a xenophobe!" Kylona said. "It's a wonder you ever left Earth. On Islandia we like meeting new people."

"On Islandia you can have sex with visitors to show them how friendly you are," I pointed out. Even visitors from Earth, which was still a great puzzlement as well as a delight to us all. We had no idea how humans had wound up on planets four light-years apart when neither one had had space flight until recently, but I seriously doubted that we would luck out like that a second time. I said, "Beautiful as you are to me, I doubt if our artichoke-headed visitor is going to find that a compelling reason to roll out the red carpet."

"He came to investigate us first," Kylona pointed out. "That proves he's curious. That's enough in common to start with."

I hoped she was right. If she wasn't, they could swat us, ship and all, like flies. But the whole point of our voyage was to explore, and it did seem pretty silly to pass up an alien contact simply because their ship was too big for comfort.

"I suppose we should let Liam and Tilbey know what we're doing," I said.

The women agreed, so I raised my voice and called their names. They couldn't hear me in the vacuum, but that was the signal for the computer to link our comm lines together.

"What do you want?" Liam asked. Tilbey didn't reply.

"We've tracked the alien to his mothership," I told him. "You want to come with us when we go check it out?" He had been a fighter pilot back in the war; I hoped he would.

He thought it over for a few minutes, probably just to make us nervous, but finally he said, "What the hell. I'm getting tired of playing golf with this bastard's head anyway."

Sudden shock paralyzed me for a moment. "What? Did you actually manage to kill him?" Tilbey had annoyed me for years with his well-meaning but nonetheless bumbling approach to life, but he was also our travelling companion. Just because we all wanted him

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dead was no reason to kill him.

"Well, he hasn't exactly joined the choir invisible," Liam said, "but it's not for lack of trying. Things work differently at this scale. I got the drop on him with a metal filing and managed to knock his head off before he could lower his coupling constant, but his ghost generator isn't programmed to simulate death. His throat's still on his body and his mouth's in his head, which means he can't invoke any commands, so I've been amusing myself by playing keep-away with him, but it's been a couple of days and it's getting kind of old. Here," he said, apparently to Tilbey, "get your shit together and come on. Command, body scale 100 percent."

He sprang up out of the floor only a few feet away from Etinitu. "What's this mothership look like?" he asked, leaning forward to look at the telescope display. "Not like a—holy mother! You could'a warned me before we were ready to dock."

"Look at the range," I told him, watching the floor for sign of Tilbey. He wasn't *liable to be in a good mood* when he got his body back together.

Liam couldn't have cared less. "Oh," he said. "I assume you've—"

"Yes," said Kylona. "The readings are correct."

"Well I'll be damned." He cranked up the magnification on a random part of the alien ship and we found ourselves looking at a bump on a stick that protruded from a spherical nodule at the edge of a row of cubes. At that scale we could just make out windows. Thousands of windows.

Tilbey still hadn't put in an appearance. "Liam," I said. "Is Tilbey going to be all right?"

"I wish," he said. "But I doubt if there's any way to change his basic nature."

"I meant—"

"I know what you meant. And yes, when I left him he was sticking his head on his shoulders and doing the 'Silent Scream' schtick. When he gets over his sulk, he'll show up." He turned toward the patch of deck he'd just expanded out of and shouted, "Tiiiiil-beeeeey! Ollie ollie ox in free! Come on, let's get this show on the road."

A moment later Tilbey expanded to normal size, but he didn't look all right to me. The expression on his face sent a chill down my spectral spine. This was an infinitely wiser, infinitely sadder, and infinitely more guilt-inspiring Tilbey than the one I'd known all these years. Maybe holding your own head in your hands does that to you. If so, I wasn't eager to try it. Just looking at him made me want to switch off my ghost generator and make that final plunge into darkness so I wouldn't have to contemplate whatever thoughts could bring a man to wear that face.

Even Liam took a pause when he saw him, but Liam had never been what I'd call sensitive. He just said, "Oh, get over it," and turned back to the controls.

Tilbey didn't say anything. He flexed his hands a time or two as if thinking about having a go at ripping Liam's head from his shoulders, but he moved no closer. Etinitu, who had been his sweetie until we'd all succumbed to cabin fever, said, "Tilbey?" but his expression didn't exactly encourage her to try the hugs and kisses approach to reconciliation, either.

He just stood there like Banquo at the banquet until we all turned guiltily away. Okay, maybe we had been a bit hard on him. But jeez, the guy could get on your nerves.

We definitely needed some external stimulus. Fortunately, a near-infinite supply of it waited just a million kilometers away. I said, "Why don't we boost over there at high-gee? Now that we're all back to normal, we can use the confinement fields and get there in less than an hour."

Nobody argued against it. Tilbey still said nothing, but he followed us into our acceleration cages, and once the

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magnetic fields had a good grip on us; Liam flew us in toward the alien ship.

There was no obvious place to dock. We did a couple of loops around it looking for the welcome mat, but we didn't even find a service entrance. Nor did we see any engines, attitude controls, or a cockpit. Just a haphazard collection of living quarters with softly glowing windows.

We tried hailing the inhabitants by radio, but there was so much radio traffic already that we couldn't tell what they used for a command frequency and what was just entertainment. We couldn't understand any of it and nobody responded when we broke in on their broadcasts, so we finally gave that up and resorted to playing Peeping Tom with the telescope at close quarters.

What we saw through the windows was both fascinating and disconcerting. The ship was full of aliens, all right. Aliens of every description. We never found another artichoke-head like the one that had come to investigate us, but we saw plenty of other fruits and vegetables, along with marine life, reptiles, insectoids, and the occasional almost-mammalian. All of them were engaged in domestic pursuits of one sort or another; cooking, eating, cleaning, eliminating, making love, and even making war. One whole arm of the ship seemed to be engaged in a bitter dispute over something. We couldn't figure out what it was, but something buglike and something like air-breathing jellyfish were busy killing each other wholesale throughout a volume of living space maybe the size of Pennsylvania. It was less than a thousandth of this ship's total cubic.

Liam dubbed the entire thing the *SS Kitchen Sink*. Our theories of what it was ranged from interstellar housing project to Noah's Ark to a galactic United Nations, but one thing we agreed on was that it was big enough and diverse enough to be all three.

We finally decided to go inside and ask. I don't know how live explorers would have accomplished it, since we never spotted an airlock, but what we did was park the *Spook* outside a bank of windows where the beings on the other side had at least noticed our presence, then lowered our coupling constants and slipped in through the walls.

They had been watching us through eyes mounted on stalks atop bodies like scaly orange pears, making what looked like "go away" motions with little Mickey Mouse hands at the ends of improbably thin arms, but we decided maybe we were misinterpreting their gestures. Maybe we weren't, or maybe we just surprised them, but when we slipped through the glass like wraiths, they pulled eyes, hands, and stubby little feet into recesses in their bodies and sat there like pear-shaped rocks.

We didn't investigate closer, because there was gravity inside. None of us were expecting it, least of all our ghost generators back on board the *Spook*, so we fell to the deck the moment we crossed the glass. A six-person pratfall would probably have broken the ice a little if we'd stopped there, but of course we didn't. With our coupling constants turned low, the deck offered no more resistance than the window had, so we dropped through and kept right on going.

Tilbey said the first words we'd heard from him since he'd rejoined us: "Coupling constant 100 perceeeennt!" dopplering to nothing as he dropped through deck after deck.

We regrouped a few dozen decks down, in an apartment belonging to a different kind of alien. This one looked like a five-foot-tall, mangy chihuahua and apparently lived alone. I could understand why. Sorry, but ugly is ugly the Universe over.

Apparently spooky is spooky everywhere, too. When we dropped into its apartment the chihuahua screeched like he'd heard his owner say "We're going to the vet," turned around on his stick-

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like, quivering legs, and raced into one of the back rooms. We heard a door slam and a lock click.

The apartment looked just like what you'd expect an apartment to look like anywhere. A couple of big chairs, a couch (which I couldn't help wondering if the owner let himself sleep on), a video monitor on the wall, and various lamps and vases and knick-knacks scattered around on end-tables. It was mildly interesting to note that an intelligent dog lived pretty much like anybody else, but it wasn't the sort of place that invited further investigation.

Kylona said, "Let's try knocking on somebody's door like normal people for a change. Somebody who's not already scared of us."

That seemed sensible enough, so we left the chihuahua's apartment to look for someone less excitable, but we found ourselves in a wide hallway where two more members of the same species were approaching warily on their hind legs, holding shiny metal pistols of some sort in their upper hands. That much of their anatomy, at least, looked humanoid; they had opposable thumbs and fingers enough to grip things with.

They were pretty clearly cops. The one we had just dropped in on had apparently called for help. They didn't shoot, which was a hopeful sign, but they started growling and yelling at us before we could even say, "Hello." I was glad they didn't bark—that would have been too strange—but I didn't like their attitude even so.

"Shall we try again elsewhere?" I asked.

Liam said, "Fine with me. Cee cee twenty percent." He faded to practically nothing. This time his ghost generator knew to compensate for gravity, so he didn't fall through the floor. He just walked toward the guard dogs and said "Excuse me" as he drew near them.

They didn't like that one bit. They opened fire with their pistols, trying to hit Liam, but since their bullets went right through him, they hit us instead.

Bullets on a spaceship, I thought. *That's not too bright.* But maybe these guys had never invented lasers. I didn't stick around to ask; my coupling constant was still set high and the bullets were punching great big holes in my chest. Not deadly, but annoying as hell. I managed to gasp "Cee cee twenty percent" while I still had lungs to do it with, and the women did the same. Tilbey was a bit slow, so he took the last few rounds before the guard dogs ran out of ammunition, but he managed to get the command out, too.

Liam pushed himself through the floor, apparently figuring that would be the quickest way to escape the trouble we had created here. We followed him, and kept going another few levels when we kept startling more and more dog-aliens, all of whom proved hostile. We finally dropped into an empty room filled with buzzing machinery of some sort, and paused there to let our ghost generators edit out the physical damage to our bodies.

"This isn't exactly the warm reception I'd been hoping for," I said when we were all together again.

Tilbey snorted. "Maybe they've been in space even longer than we have." He had a point. He and Liam and I had gotten along pretty well when we first started out from Earth, but time and proximity had changed that.

Liam said, "You don't get cabin fever in a ship this size."

Tilbey clenched his fists, then slowly released them. He didn't say a word.

"Let's try someplace else," said Yavetra. "Maybe it's just the people around here."

Liam shrugged. "God knows, there's plenty of someplace else to try."

So we shoved off through the outer walls, went back to the *Spook*, and took it across to another hundred-kilometer-long skyscraper, where we found yet more varieties of interesting creatures,

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none of whom seemed any happier to see us than the first ones did.

After the fifth or sixth race chased us away, this time with knives and pitchforks, Liam said, "You know, I'm starting to take this personally."

Tilbey smiled. It was getting on my nerves how quiet he'd been since he and Liam had started fighting. I tried to remember if he'd actually spoken to Liam yet, and couldn't think of an occasion.

Kylona said, "This doesn't make any sense. Why won't anybody talk to us?"

"We don't have a language in common, for one thing," I said, but that wasn't the reason and I knew it. This ship's inhabitants didn't even try to talk. They just gave us the bum's rush the moment they saw us. But there were so many different species on board, what was one more? It didn't make sense.

Okay, sure, we were ghosts, but how did they know this wasn't our normal state? Some of the creatures we saw looked just as spooky as us. Did all aliens have legends of foggy beings who haunted their dreams? I sincerely doubted if all the different varieties we'd seen here even dreamed, much less were scared of ghosts. Yet they were all, without exception, scared of newcomers.

We were still arguing whether or not to try again somewhere else when an alarm siren howled loud enough to rattle our teeth. It gave three loud hoots, then went silent again.

"Ah, hell," I said. "They've sounded the general alarm."

"I don't like this," Liam said. "I think it's time to get back to the *Spook*."

I wasn't particularly impressed with these aliens' technological abilities, but they made up for it with sheer hostility. If they wanted to damage our ship, I had no doubt they could. "Yeah," I said, "Let's—"

Then the Universe folded up around us like a picnic blanket enclosing the last few ants. Light vanished. Space vanished. *We* vanished. Only time seemed to remain.

I had already died a couple of times. This was no more pleasant. Experience had removed some of the panic, because I knew that some part of me did persist after death for my ghost generator on board the *Spook* to amplify, but surviving a lightning strike doesn't make a person eager to try it again.

I couldn't tell whether the *Spook* had been destroyed, and thus I was now a permanently disembodied point of view, or if something else had happened, but I clung to the notion that the aliens would have had no reason to warn everyone if they were just going to blow up our ship. This was some kind of internal thing.

Time passed, but it was entirely subjective, so I had no idea how long it was. But eventually the same universe-bending sensation rippled through me, and we were back on board the *SS Kitchen Sink*.

Liam growled, continuing on toward the outer wall as if he'd never been interrupted.

"What the hell was that?" I asked.

"Hyperdrive," Tilbey replied.

That stopped Liam. "Hyperdrive?"

Tilbey shrugged. He spoke to me rather than Liam. "Just guessing. But we didn't see any regular engines, and I can't imagine this thing holding together under normal thrust anyway. That's got to be how they move from star to star."

"Assuming they're even interested in stars," Liam said.

Tilbey ignored him, but Liam was right. We had no idea what the inhabitants of this immense spaceship wanted, other than to be left alone. Nor did we know what they'd done just now, but the best way to find out was to head back to the *Spook*. That, at least, we knew was still intact, or we wouldn't have been there in physical form to talk about it.

It was right where we'd left it. The Universe wasn't, though. We'd been

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light-years from anything a moment ago, but now there was a bright sun blazing in the sky below our feet as we emerged, and a blue-and-white planet hung like a soap bubble straight ahead.

And thousands of little specks of light were receding from one of the starship's arms toward the planet.

"Missiles?" I asked. Nobody else ventured a guess. We rushed back to the *Spook* and focused our telescope on one of them, but it looked more like a landing craft than a missile.

We watched it enter the atmosphere, blazing like a meteor until it slowed enough to fly on its stubby wings, then it circled around to kill more velocity and flared out to a landing in an open meadow near a forested hillside. At high magnification we could see a door pop open, a ramp slide out, and dozens of barrel-shaped aliens push their way out into the open, looking for all the world like escapees from a theatre fire.

We searched until we found another lander. This one had disgorged a nest of bugs. A third one landed in an ocean and released octopuses, which slithered over the side and into the water. All of the passengers we saw, even the octopuses, carried armloads of tools and bags that looked like suitcases, and their first order of business seemed to be to get the heck away from the lander. None of them came back.

What *did* come back, in every instance we could see, were avian creatures that looked vaguely like pterodactyls. They would land nearby, creep closer and closer, then eventually go inside. They would come back out unharmed, then go back in again, more and more of them, until suddenly the door closed, the ramp rolled up, and the lander rose into the sky again.

We watched the same thing happen over and over again for a couple of days. Eventually all the landers rose back to the mothership whether they were full or not and docked in the same spot.

Curiosity got the better of us. We had to go see. Fortunately we didn't even have to go inside to confirm our suspicions. The landers were docking to the side of a living section that was already inhabited by mobile telephone poles. At least that part of the ship had high ceilings so the bird-aliens could fly around. Not that it mattered that much. The telephone poles didn't like seeing thousands of newcomers moving into the neighborhood. They quickly organized into gangs and tried to wipe out the birds as they left the landers. They would have succeeded, too, if the starship itself hadn't joined in the fray, driving them back with some kind of blue laser beams so the birds would have room to band together.

They clearly hadn't expected this kind of reception. Most of them tried going back into the landers, but none of the vehicles budged. They were stuck. It's hard to read emotion on a bird's face, but as we peeked in through the windows and watched them advance slowly into the ship, I swear we were seeing horrified resignation in their features.

Equally horrified, Kylona whispered, "We have legends about this."

"What?"

Liam busied himself with flying us away from the enormous starship, but the rest of us looked at Kylona.

"Every island on our planet has the same creation legend," she said. "Many generations ago, our ancestors came from a giant ship that brought us from a distant, bigger island on the other side of the sky. It had to have been like this."

"This enormous zoo scooping up curious Cro-magnons from Earth and dropping them on Islandia?"

"Probably later than that," Tilbey said. "We'd have evolved farther apart by now if that was the case. We're so close that I can still see regional similarities in some of Etinitu's features. Her nose is Egyptian, for instance. Her hair Polynesian. Her lips African."

"There are a lot of stories about strange visitations from the sky about

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three thousand years ago," I admitted. "But why haven't we got a couple dozen intelligent species on Earth, then?"

Liam laughed. "With humans already on it? You've got to be kidding. We ate them for lunch."

Probably true. We could hardly keep from killing each other over skin color, much less body shape. "But . . . Islandia?"

Etinitu said, "There are legends of Islands far away where the people are oddly formed." Her people still used canoes to get around, so it was entirely possible that isolated pockets of alien life could persist there for centuries. Provided they could survive the climate. The sampling techniques the alien zookeepers used didn't seem very discriminating; I suspected most of their transplants died out quickly.

But a few of them didn't. Over the course of millennia, this ship—and maybe others like it—was busy homogenizing the galaxy. I wondered why anyone would go to the trouble, but then I remembered something I'd done when I was a child, and I felt a shiver run down my spine.

Every kid I've ever known has put bugs in a jar. Most of us weren't satisfied with one species, either. Whatever looked interesting, we'd snatch them up and toss them in together. Occasionally they would fight, and we would watch to see who would win. Sometimes if they made a truce, we would shake the jar to make them fight again. When we got bored with a certain species, we would empty the jar on an ant pile and look for something else.

The bugs must have wondered why we went to so much trouble to disrupt their lives. What had they ever done to us, anyway? Of course they had done nothing, save catch our attention.

I looked out the window to where the bright blue-and-white planet, home to an avian species with more curiosity than was good for them, beckoned softly in the darkness of space.

The starship cast a shadow on it a third of its diameter. Then suddenly it didn't. I looked out to where it had been, but it was gone. Off to another ant pile. I felt a little disappointed that I wouldn't get to meet the aliens who had built it, but I wasn't that disappointed.

Down below, hundreds of different species were puzzling over their new living arrangements. Some were probably cursing their fate as they realized the air wasn't breathable or the temperature wasn't right. Others were probably thanking their various deities for deliverance. But all of them would have stories to tell.

"What do you think?" I asked. "You want to go see if anybody's more willing to talk to us now that they're on the ground?"

"Nah," Liam said. "Let's just keep going."

I looked up at him in surprise, just in time to see Tilbey swing a clenched fist at Liam's head. He connected with a hollow *thunk* that reverberated throughout the ship—only because we were hearing it through Liam's interface. That's what it had sounded like to *him.*

Liam was so totally shocked that he didn't even swing back. He just shook his head, waited for his vision to clear, and said, "Feel better now?"

"Yeah, I do," said Tilbey. "If I do that a couple hundred more times, I might even—"

"Don't push your luck."

"I wouldn't dream of it," Tilbey replied.

I smiled. It was good to see them speaking to one another again. ■

(EDITOR'S NOTE: Previous stories of the Astral Astronauts include "Cabin Fever" [May 2002], "The Menace From Earth" [October 1999], "Kissing Cousins" [November 1998], "Why Didn't You Think of That Before We Left?" [March 1998], "Cease and Deceased" [October 1997], "Holiday Spirits" [January 1997], and more.)

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Wherein a new way of life gives new meaning to an old cliché . . .

FINDING MYSELF

Brenda Cooper and Larry Niven

"Listen, it's *not* here." The teller's voice edged up at the end of words. She looked up at me in dread.

"Erased?" I demanded. I'd come to refresh my backup copy. Discovering that I'd been running around with no backup; that was unnerving. But the teller was in terror. Surely she could see my own rising fear, even masked by anger.

She wrenched her gaze away, back to the keyboard and monitor screen, and typed.

Suddenly I understood. "Booted up? *Loose?*"

"Y-yes. Twenty-six eedays ago. The records say she was uploaded. The door tab says you left. You didn't come in, but you left. Please, would you just—" she flicked her eyes side to side as if scanning for help.

A row of teller's windows stretched away to infinity in both directions. This whole virtual universe is only a picture; success and government get painted big. A few other customers were mere specks halfway to the vanishing point. Nobody could have overheard this idiot pronouncing a death sentence upon me.

I waited for her to start screaming. Despite the barrier she was afraid of me. Maybe she'd already hit an alarm.

But no guard popped up. I broke my glare and turned on my virtual high heels and stalked across the hall to the storage cubicles.

The Storage Bank doesn't lose clients. But I'd left, and I hadn't arrived.

There were two of me. When the Board knew, one of us would be erased. Depending on intent, we could both be erased. But even through my fear, it registered that the teller wasn't going to do anything about it yet.

I made my way into a spare storage cubicle, and set parameters for a fresh backup that would record my memory, my self. The eeseconds it takes to make a backup seemed to go on for eehours. I sighed with relief when the disembodied voice claimed "done," and stored me.

The marker booth in the entrance was dressed with an imposing neon sign; "Performers and Artists Guild: Governing Board Storage Bank." Departure was as simple and quick as selecting an address and pushing it to the booth's address variable. I marked to a small park I knew.

In the eeworld I'd never felt in danger for my life. I let it flood over me, the fear that had been knocking at my insides. Sweat flooded my armpits . . . and I turned that off. Too distracting. I had to *think*.

Some of us never sleep. We don't need to sort our memories, to dream, as bios do. Most of us maintain the habit of sleep without missing anything: we're out for a few seconds that record like hours.

Most of us bathe. Many of us don't brush our teeth or our hair. Some of us

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don't eat or drink, but that's risky. The habit of being human keeps us sane. We are basically the same people who lived our lives as biologicals and, when our bodies were unable to maintain us, were made young and alive again.

We live faster than physical humans. This might be all the time I had—ee-weeks or eedays for me in virtual space, hours or minutes in the biological world, until someone still flesh, still *real*, saw what had taken place.

I had to find my other self.

I started in the obvious places. My own digital haunts. After all, how likely was the second me to go someplace I had never been?

Running for her life?

But she might not know that yet. I marked to a folk rock club, the Glad Hand. It was a place I earned chit singing backup vocals on nights the band played, my only paying work. In a pinch I backed up other bands. I never did solos.

Frank, my bandmaster and the Hand's part owner, prefers the Hand a little crowded in the evening. He expands or shrinks the space and the dance floor to keep it that way. Crowd noises damp out, and space warps a little so that nobody in the audience is where he can't see or hear the stage.

Afternoons, the place used to shrink to phone booth size, until Frank came to his senses. A bar *should* feel empty in the afternoon. The Hand was quiet and shrunken. I hung back, checking it out before committing.

Ten or twelve patrons talked over tables and booths along the windowed wall. All were regulars, mostly wearing young bodies clothed in the current fashion: iridescent paints, mirrors, and fringed scarves. An antique radio, blown up to two meters tall, played antique music next to the huge empty stage. Frank was sitting with a girl at a small round table. I considered it a mark of sophistication to be less than perfect here; Frank was sophisticated. Bodies should not be changed rapidly even in a virtual world. Frank had grown a rounded beer belly, ragged and patched whitewashed jeans, and chosen a scraggly beard with hints of gray in it. A true old folk rock persona.

The girl was new or naïve. She'd stayed blandly, blondly beautiful.

It looked safe enough. I walked up and pulled a chair out, sat backwards in it so my long legs split around the back of the chair.

"You missed practice this afternoon. Where ya been?" Frank asked, looking reasonably happy to see me.

"Trying to find myself." Lame humor. My worry level was high and I wasn't thinking too fast. "Hunting new tunes," I said.

"I always like new score." Frank drawled, affecting an attitude. Probably for the chick he hadn't introduced. "Play for me?"

"Not yet. They're in my head still."

"Hmmm. Holding out on me?" Frank grinned, teasing me in front of the new girl. But he pushed a song my way, and I saved it in memory. "For our next gig. We start practicing next Monday."

"I'll be there." Or I'd be deleted. I didn't like lying to Frank.

"Aren't you going to listen?"

"At home, man. See you around." I did my best to resist doing the digi-chick sexy walk thing as I headed for the door.

Frank didn't seem to have seen me since I'd seen him.

I tried the other music bars I liked; Blues River, Shorty's, Danube Dreaming, and the Wild Eye. Yeah, my taste is eclectic. No matter though, I wasn't at any of them, and no one seemed to have seen me. The passage of time was fingernails on slate in my mind's ear. At least no one else seemed to be looking for me.

Where was Rogue Christa?

I marked home.

Home this year was a facsimile loft

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above a riverfront. The walls were lined with music equipment and surrounded a huge expanse of bare wood floor punctuated with a few big pillows. Tall thin windows let in stripes of light as if there were a real sun here. I left the music off, and curled up on a big blue feather pillow. Lying back, I watched myself in the mirrored ceiling, willing my limbs to relax.

It wasn't working. I got up and ran through some yoga, forward bends and the warrior poses. It was a way to let go and work out the fear, one that had worked for me when I was flesh. Yoga's mind/body link was needed here.

I stretched while I ticked off possibilities.

Deep forward bend. Hold it, lengthen the thighs on inhale, lower the torso on the exhale. Hold it. Maybe the backup had been erased. After all, I hadn't found myself yet. But the bank teller said she'd walked out. Better believe her.

Why didn't the teller turn me in?

Widen the stance. Lean forward, bend at the hips. The chance of a mistaken backup release is supposed to be some huge power of ten to one. The Governing Board claims there's no room for mistakes, that this is a program with no bugs.

If I could get a hearing and talk fast enough, the Board might not erase me. Make them erase the rogue instead . . . but what were the odds?

Right foot forward. Knee over the ankle, bend, arms out front and back. Rogue Christa would know she's a backup by now. She'd be looking to find out what happened to me. After all, *I'd* be curious. She'd have come home to legitimately pick up the pieces of my life. I should have found myself by now—it should have been easy.

Left foot forward. Remember to hold the chin up. Digital beings have selectable memories. This situation could only kill *me*. I would live on as the rogue backup, minus only those things I'd written to memory between recordings.

That was an interesting thought—the memories between backups. It was a place to start. I didn't want to die—I was clear on the concept that I was not Rogue. I started to replay the last month of my life.

We'd done a retro show at the Glad Hand. Old ballads primarily; Joni Mitchell, Eric Hightower, Linda Ronstadt, Bob Dylan, Eagles, and Garth Brooks. Most of the time I watched the band sweat and dance from behind.

I could sweat too. Musicians sweat when we're hot, most of us, because it makes a better show. It's programmed in, autonomic, but with a mental off switch, as with the sex urge. So much in our world is optional.

Frank was known to paint ciphers into the Hand on slow nights. Or not. A month ago we were doing all right: the Hand was cozy, everyone looked real, and not too many people wandered out while we played. We had a party after the show, a real good jam. I watched, listened, enjoyed.

There were solo shots from the next day—some changes I made to the window views and recordings of original music I was modifying and changing. All new work, created in the ten virtual eeyears since my digital choice day. The work was joyful but convoluted, celebratory of our digital medium. I'd spent the day alone, it seemed, and bored: not much of it was recorded.

I had a night out with some friends in the band, went home alone.

And it went on like that. Nothing unusual.

I played the memories back a second time, cross-corelated, mixing them up to look for patterns. Where had I been, who had I talked to? Then I focused on the backgrounds, sharpened them and watched carefully, freezing frames. Twenty-six nights ago, early, in a moment when I was standing near the front and belting out lines from *Me and Bobby McGee*, I spotted my profile.

She was scared, turning away, walk-

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ing tense and head up. It had to be Rogue. Two frames later there was nothing left of her, just a dancing crowd closed in front like a locked door.

I rewound and watched again. There wasn't anything else useful, no companion, no way to tell where she went. Whatever started this nightmare must precede the frame with Rogue in it.

I replayed it three times, start to end. She didn't appear again. When I finished the third time, I was so sick of my recent past I wanted to erase the whole thing. Replays show every time you record a memory you don't really need, and every time you cut in on a scene and it seems you've missed an important beginning. But I was afraid of editing a clue.

I'd nailed the two weeks in which Rogue Christa had been booted up. What had caused that to happen? Something I saw and didn't record? A memory that got lost? Erased?

Slow repetitive work had sanded the hard edge off my fear, but the bulk of it remained, heavy and pushing.

I needed help.

I marked over to Nita's. The best and oldest digital queen I knew, and better yet, a hacker from even before she came here to live. Myself, I've always been a singer, and for a while I was an accountant. And Nita the dancer and hacker, my friend, owed me one. I'd watched her back a few weeks ago while she did some intel work. It made her enough chit for a year, and I'd refused a share, having a general fear of any kind of dirty electrons. Even chit.

She lived in a cottage with views of rolling hills and a Victorian garden. She'd designed the garden herself, with earthy green scents and even weeds amidst a tall riot of purple and pink flowers. Typical hacker; big bandwidth spent on a small perfection. I bet I could even have found tiny spider webs in the dewy grass. The views, of course, had no real dimension, but the illusion of privacy was a breath of fresh air after my city loft.

"Christa?" she called cheerily, "Come in." Nita wore only shorts and hair—and a delicate lacework of body ink making a fall of open and closed spaces down her breasts. Her hair iridesced in green and yellow. Bright orange sparkly paint covered her fingernails and toenails. I felt better already.

She was sitting on a simple stool surrounded by screens on the walls. On some of them, letters and numbers danced top to bottom in scrolling patterns. Other screens played video of dancers performing jumps and high aerial work.

"Hang on, Christa, I'll be right with you." She watched a few more moments of two of the videos, swiveled around to freeze some programming, and then waved her hands, stopping everything in place.

"Nita! Hey girl, I need help with something." I cued her with our warning words: "I'm having a bad chess day."

That was *her* cue, when she wanted help with some push at the world rules we had signed in by when we traded our biological selves for electrons. Even here, she'd taught me to be careful if she had open feeds of any kind.

She looked up at me—raised her eyebrows. But she made no sound, just sat for a bit, communing with her house systems. The light changed to a soft strobe, and Nita got up.

"OK. Safe."

"There's two of me."

"Huh?"

I filled her in, my voice cracking as I spoke out loud. The words seemed to hang in front of me, condemning me, even as I knew this was as safe as it could be. I dared not forget these moments; unrecorded time doesn't remain part of me. So maybe not so safe. I felt like I was traveling down a long tunnel and could never emerge at the place I started, and maybe never anywhere else either.

Nita said, "You were here yesterday."

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"Nope."

"Yep."

"Damn." Then, "What'd I say?"

"Hi, mostly. You—Rogue, you call her?—were a little antsy. Stayed about an hour. But she was you—she knew me and knew how to get here. Of course, a full backup would match. I had a sense there was trouble, but nothing was said. It wasn't really much of a sense, not so I felt I needed to do anything." Nita looked up at me. "Sorry."

"Did she say where she was going? I didn't see any signs of her at home."

"No." Nita pushed her memory of the visit at me. I took it, looked, and replayed some scenes. Stored it. Since I was seeing myself in it, I could never confuse that hour with my own memories, but I sequestered it anyway. It was highly surreal to watch myself and not remember the event. But it was me. Her.

If Rogue hadn't gone to any of my predictable haunts, then she must know she was a duplicate. I stood up and paced. "Did she talk about this?"

"No, but she was watching the time."

"You couldn't tell she wasn't me?"

"She was you."

I kept pacing.

Nita looked puzzled. "Are you worried about her?"

"No, I want her to go away. She's just a backup."

Now Nita looked pissed. "I was worried about her. You." Then she stopped for a moment and was completely still. "But one of you does have to die," she whispered. "Oh man, this isn't supposed to happen." She sat down hard, flashy orange nails running through her hair and massaging her scalp.

Obviously, if there could be multiple copies, the social order wouldn't stay the way it was. Who'd be the real one? We may be a colony of digital humans, but our voluntary migration into a form of AI left us with the old societal drives, good and bad. Thank God for the Governing Board. Usually.

I passed Nita my glimpse of Rogue in the Glad Hand, then everything I could remember of being in public for the previous week. Nita skimmed, then went through it all more carefully. She muttered, "The way we trade memories, does it really matter who's who?"

"If we lose that sense of identity, we're dead," I said. Ash in a jar. There had been a cremation and a memorial service. I hadn't attended, but I knew. *Dead.*

Nita wasn't listening. "A rogue backup was booted up. Why? I'm thinking you must have seen something, learned something. Somebody wants the rogue in place because she won't remember. But I can't see anything weird here, Christa."

"I don't either."

"We'd have to review your whole damn life, flesh and virtual both. This is no good. We need a different approach."

"I've got to find her, Nita."

"I know."

I got up and turned around to leave. Nita's voice stopped me cold. "And how do you intend to do that on your own?"

I had no idea. "I'll just keep looking, I guess. Hope we don't end up in the same place in public."

"I can help you."

"It's not your problem." I sat down again. "I'll take advice."

"You'll need more than advice."

"I can't put you in danger." She could be in real danger too. As a hacker, probably she was already watched. She knew it.

"You're too sweet, Christa. You'll get caught for sure. I can look for you without you being there. I can manipulate recordings to edit you out if need be. I have various other talents, too." She waggled a finger at the screens around the room. "You need me."

I did. But I didn't like it.

It took five eedays. We based operations at Nita's. I watched her hacking around in the recording systems looking for any signs of me we knew weren't

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me. Nothing. We marked back to my place from time to time looking for clues. Since there was no sign of authorities looking, we decided Rogue must be hiding.

Out and about, things seemed normal. By the third day, we'd decided they were normal enough that I'd best do whatever I would be doing if I weren't searching for myself. Otherwise Frank or someone else might report me as missing, and that might be as bad.

We were at the Glad Hand waiting for my set to start. The lounge was midsize and half full, just starting to pick up energy and life for the night. Patrons came in regularly through the marker door as singles or small groups. Nita and I were playing chess and laughing, relaxed by the normalcy. Nita was starting to talk about doing intel for a new bioworld client, something about looking up viewer traffic patterns related to new participatory arts. That was our main product from this net—entertainment for the biological masses. Some digital nets worked on medicine, some on social sciences or security or even history, but this site existed for the sake of art and performance. What she did billed out as product research, and this gig was even legal, so we could plan together out loud.

We were engrossed in talking about the new client, discussing the merits of my last pawn sacrifice, and commenting on body art. We didn't see the man walk up and pull out a chair until he was seated at our table.

I went on instant alert. I'd never seen him before. He was dark, his looks patterned on the Mediterranean: intense eyes, dark hair, and a small frame. His clothes were bland—jeans and boots and a tan flannel shirt. It would take work to notice him in a crowd. I raised my eyebrows at Nita and she shook her head slightly. She didn't know him either.

He looked at me as if I was a ghost. "Christa." He just said my name. Quietly. It wasn't a question. Then he said "Christa Two."

I tasted the risk. Fear of never knowing was worse. I said, "No. One."

Nita's eyes narrowed, telling me I was crazy. I shrugged. He caught it. He held out his hand and said, "James."

We both went still, and waited for him to say something more. Nita didn't offer her name, and I didn't take his hand. The moment seemed to take forever.

Then he got up. "Follow me."

We got up. He gestured at Nita: *stay*. I said "No."

After a bit, he turned and walked away and we followed him toward the marker door. I ducked low, not wanting Frank to see me running out on a gig. I hadn't practiced much anyway.

Once at the door, James pushed a mark to Nita and me. We compared: they were the same. The address was long, somewhere in the hinterlands of the digital world. I didn't even recognize the main server/street.

All three of us marked out at the same time.

It was a campground. No place I'd ever been, or even heard about. My signature high heels didn't match the terrain, and the soft forest floor felt strange and knocked my gait off a bit. Nita looked less shocked than I felt—she must've been someplace like this before. I liked the outdoors when I was physical. Virtual outdoors felt like a sin; I spent my time in the city.

James led without a word to either of us, walking easily on the uneven path. Camp-style homes nestled back in fantastic stylized woods. The tents and yurts were reds and yellows and blues too vivid to have been made with physical materials and dyes. A few even floated in the bright branches, tethered with colored ropes or light chains. The path and homes were distinct, the forest behind them fading into a surreal mural. We followed James for a long time.

Just short of the path's effective end,

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where it swooped up the mountains in a chain of impossibly narrow switchbacks, he stopped at a simple soft green yurt standing in a rudimentary flowerbed.

Those flowers! James was definitely not up to Nita's standards for digital home making. Or maybe he was just memory-poor. We ducked inside a flowing silken blue door.

Rogue was curled up in the corner, face to the wall.

I stopped in the threshold while James and Nita settled into pillows along the wall. My eyes were glued to Rogue. You never see yourself this way, even digitally. Oh, I'd seen myself on Nita's film and on vids of the band. But this was real. Three-dimensional. Not a mirror.

I was long and thin and angular with long dark hair. Mine fell down my back in waves, Rogue's was in a ponytail. Her shoes made more sense than mine, and she had traded the silvery mesh top and dark leather I wore for a simple long blue dress. It made her softer, more feminine than I recall ever looking. Otherwise we were the same, though we had lived different lives these last few weeks.

She rolled over and looked at me. Did a double take. Put her hand to her mouth. "Shit." Rogue's voice was husky and scared, and oddly, it didn't sound like my voice sounded to me. "Sorry. I've been hoping to see you."

Nita and James watched. It crossed my mind that Nita cared about us both, James only about one. I felt ephemeral again. Defensive. Angry.

"Rogue." It was the wrong thing to say.

"No, Christa."

"Yeah, I'm Christa too. I mean Christa One." She looked at me—shocked. How would I act if the situation were reversed?

But it was.

"Oh God, now what?" I asked.

I sat down opposite her on the floor of the yurt and forced my attention to James. "How?"

"I found her. She seemed hurt, dazed. She was in the door of the Glad Hand. The group, you, were singing Joplin. I didn't know it was you—that she was you—about the backup. I liked her. She obviously needed help, so I brought her here." He glanced sideways at Rogue, face softening. His voice broke. "Please help her."

I knew he was asking the impossible. He must know it as well.

Rogue started to talk softly. "I marked out of the Bank thinking I'd only made a backup. When I saw it was the wrong date it scared me. I thought I'd been killed and reborn . . . rebooted. But when I went to the Glad Hand, there I was on stage singing, or there you were. I knew something was deeply wrong and I shouldn't be here. I went to Nita's, but I could tell she didn't know. I went back to the Bank, demanded information. But no one had any, and the Teller acted like I didn't exist. I couldn't tell them you were still alive, although I . . . I wanted to."

Of course she wanted to live. I could look into myself and know what she must feel too. Fear and anger and angst. This wasn't solvable. I wanted to hate her, or see her as software, or something, but, of course, she was me. I didn't hate myself. Maybe I would before this was over.

She went on. "I marked to the park, knowing you wouldn't be there while you were singing. Someone came up to me, a nice-looking man, and said he wanted to talk. He knew me, I didn't know him." She sounded a little defensive.

"I sat with him. He knew something, and I needed to figure out what was happening, to find a way to save myself. He said his name was Dean and, well, he seemed OK at first. It was as if he designed himself to be someone I'd like personally." Here she glanced at James. She looked apologetic, but he smiled at her and she kept going. "He said he was

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representing Evie."

"My granddaughter," I said to James and Nita. "Our," to Rogue, because she flinched. I sifted for memories of Evie. Our old lives weren't supposed to affect us. Besides, time moved differently here. If I had been here for what seemed like ten eeyears, then a few months had passed outside. The Evie I knew wouldn't ask for money. That much wouldn't have changed. There hadn't been time.

Rogue continued, "He acted nervous. He said Evie needed money. That the reserves I have are enough to support my life here even if she took half. He didn't say why, and he sounded like a used car salesman. He wasn't even very convincing. I thought . . . thought that if I said yes, I was betraying us both, and if I said no he would just zap me and try another backup. And I wanted to live."

I said, "I do too."

She just looked at me for a long time, measuring coolly. I had no way to respond, I couldn't erase the tape in my head that said she had to die. Maybe she was hearing the same tape.

"He got harsh about it," Rogue said. "Didn't directly threaten me. Hinted. He said he wanted me to go somewhere with him. I was scared, so when we got to the marker door I marked to the Glad Hand instead. I was afraid. I'm so sorry." Her eyes still on me, she plucked at loose hairs, and tucked them towards her ponytail. "But it must have been okay. You're not dead. I was so afraid both of us in one place would kick off an alarm."

So that was when I saw her. No wonder nothing showed up on the tapes—this wasn't about something I'd seen, but something someone wanted. But why create a backup to ask? Why not just ask me?

So she could sign over the money, and be erased, and the real me would never know.

I didn't think that the avatar was really from Evie. Evie would have come in a front door, contacted a legit agent. Didn't this guy know that while I might have been a little senile on the way in, digital life would fix that? I was young and strong and had chosen the life of a woman in her late twenties.

James moved over behind Rogue, laid a hand on her shoulder, and took her offered fingers in his. He said, "When I first saw her, she was running hard for the marker door, but then when she got there she just stood still like she'd lost her address book. I offered to help and took her home with me. She's afraid to leave the tent. I didn't believe her at first since the story is so strange. She wouldn't go anywhere, just sat and talked to me and . . ." His voice trailed off. "But then I saw you."

I stared at the soft green ceiling and thought about the cardinal rules of this place. If you break them, you're dead. Keep them, and you can live forever. Simple rules. Cause no one harm. Earn your living. Only one copy of any person. No contact with the outside world except by approval, and approval was rare.

The digital country is fueled by money spent to get you in, money to buy memory, and money that buys what goes out. It was only by helping Nita that I came to understand that there was a black market in contact. Her intel work often skirted the gray areas of the rules.

"Nita?" I queried, "Any ideas?"

Nita got that far away look. James started to speak; I gestured him silent.

She spoke. "Even if she hangs around in completely different places here, the system will know it's generating two of you. I suspect it's just time and the needle in a haystack concept that's protected you from diagnostics so far. You'll have to do something."

"Can we send her someplace else? Another virtual world? Don't you know some hackers who can do that? Go between worlds?"

"*Maybe* there are people who can talk to other worlds." Nita spoke slowly.

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"But you couldn't send her to another one. The software's keyed differently, and copies kept and compared. There are master lists. The other world's operating system would know she was foreign."

"Damn."

We were all quiet for a few moments. No new ideas surfaced.

I asked Rogue to show me Dean. She picked him out of my memories: in an audience, watching, twice. I hadn't noticed him. He blended in well. Knowing him now, I could see he was watching me too closely. Backup singers don't have many fans.

We walked together back down the long woods path to the marker booth. I kept a seductive sway and the high heels; a way of remaining myself in the face of her soft shoes. Still, I took her hand over a small stream when she slipped. The touch made me shiver. I was touching myself.

James came with us, silent and brooding. I suspected he wanted to hate me, but he wasn't the type. We went to Nita's.

On her home turf, Nita dressed down to nothing but body painting for a moment, then slipped on shorts when she saw James flinch. She rolled her eyes at me as she pulled up her programming screens and used a still from my memory tape to set up a search that would pattern-match until it found Dean.

"Won't that take forever?" James asked.

"No. A day at most." A bio day: eemonths for us. "And when the program I just started learns enough, we can track him almost real time. Except that if he's just an avatar he may not be here all the time. Like the cops and some of the Board."

James looked puzzled. "Oh. I didn't think that was allowed. To be here and be real too. I mean, except for the government, and maybe scientists from outside."

"It's not."

"So now what?" I broke in.

"We stay low, we learn. Best if you and Rogue stay here. We've got to find him before he finds you."

"If he finds us, we'll know where he is."

She looked at me like I was about ten. "Christa. No, *everybody*. Listen up!" Her voice rose. "If Dean's an avatar, then someone on the outside in biological space is running him. He has at least one ally in here. Think of the bank teller: she *must* be one of his, or an avatar, or an undercover cop, or just plain stupid. I'm not willing to count on either of the last two. Are you?"

"I still don't get it," I said.

"Whoever's running Dean is not too smart, we do know that. But he can get past the system security. He's technically smart. There's probably just one, but that's not something we know either. Want to bet he can't delete you somehow?" She took time to look at each of us directly, an orange glare. "He, or they, must have had a plan to get rid of at least one of you. If he finds out the Christas are together, he'll know the game is up. This could be a regular racket, and he won't risk being caught. That's what I'll do next—stalk the teller's records and look for traces of similar crimes."

Right. Right, but— "What if he'd succeeded? If Rogue Christa gave in, recorded the permissions he wanted, he'd have just deleted her and no one would have known. I wouldn't have known about missing money for a long time—probably until next year's accounting."

Now Nita at least looked at me like I might have bought a clue somewhere. "That's right. But that's not how it happened, you were smarter than that. For now, assume if he finds you, you both disappear."

So I had two enemies: the hacker who was running Dean, and the Governing Board. The avatar would probably be happy to delete us both. The Governing Board would only want Rogue. Had

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Rogue thought of posing as me? But James and Nita would know. Surely they would know.

What would happen if we were deleted? Would it be death, finally? I didn't want to find out.

Rogue and James and I stayed at Nita's. Nita came and went doing her usual business and ours. James seemed reluctant to leave Rogue's side. He feared me.

Rogue and I circled each other the first day, saying nothing outright hateful but never coming together either. We didn't touch. We stayed separate as we did one thing or another for Nita, turning sometimes to watch each other warily. I tried over and over to leave my back to her and keep it there, to hate her, to focus on the things I saw in her that I hated in myself. Then she'd say something perfect or we would both say the same thing at once, and I'd forget to hate her. We both had to be in the same physical space, and it was like trying to hate the mirror.

Although I almost never talked to him, Rogue did sometimes go to James for comfort. I would see them curled together in a corner, talking. Sometimes he would run his hand along the curve of her cheekbone and she would look up at him with something in her eyes I didn't feel for him. Whatever need had pulled them together hadn't touched me. When they were together I started keeping my back to them, watching the outputs of Nita's programs extra carefully, or messing with my nail paint.

Nita was looking exhausted. First she'd been helping me find Rogue. Now she was helping us find Dean. It was the hacker in her. She loved long hours and hard puzzles and an enemy or three. In the physical world she'd want someone shoving pizza under her door; she'd never leave a problem unsolved for something like sustenance. We are more than programs, and she was wearing herself thin.

The second afternoon she got up and cursed the lack of progress. She turned all the screens off and just stared at the blank wall, jaw tight, chin out. Rogue and I were on opposite sides of the room, knees tucked under our chins, half scared, half bored. When we saw how bad Nita looked, we both got up like mirror images, meeting as all four of our arms encircled Nita. Nita put an arm around each of us and we collapsed in a corner crying, then laughing and touching on purpose.

James stepped toward us, then turned and marked out the door.

Nita went into the other room.

Rogue and I talked for eehours. Now we were free to giggle at old memories of funny audience members and bad gigs, and to apologize to each other. But ultimately, we found we could be silent together best. There was actually little to say.

Nita smiled when she came back and found us on the same side of the room, holding hands. "That's better."

"It still doesn't solve the problem."

She ignored us on that point. "The teller's new. Helen Troya. She's been there two weeks, and there have been three backups restored in that time. That's more than usual. And the teller from before, Wilma Schmidt, she was there a month, and there was statistically one too many then—three in that time. It's faint, but it's a thread. We need to find the restored backups, or the original; whoever's still alive."

"Any idea how?"

"I'll have their names pretty quickly. Then, Christa, you and Rogue stay here while James and I go find them. We'll store and send back anything useful. It should be safe enough—I don't think the avatar knows about either of us. But you should both stay here where I've got some security built in."

"OK—but what are you going to do?"

"Figure out if our guess about the scheme is right. It's too big for us with someone on the outside, but if we learn enough, we can take it to the Governing

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Board and demand immunity for you."

"But they still won't let us both live."

"The hacker could kill you both."

"But . . ."

"I'll try and think of something. It will help to know more."

"OK. Go safely."

Nita and James were gone the better part of a day. Rogue and I fiddled together with some artwork on one of Nita's windows and then painted each other's bodies with purple and blue Celtic knot designs. I'd always wanted to be able to do my back, and time needed filling anyway.

I was completely absorbed in painting my own spinal ridges and shoulder blades. Smoother than the front. Took a picture better—

"Bingo," Nita said as she walked in the door. "We went after the most recent backups first—the ones that went through Helen Troya. We couldn't find the first one we went looking for, so maybe both copies got erased. Maybe they're both in hiding. The second one is a light technician at the theatre. I gave her my cop ID—"

"Dangerous," Rogue said, and I said, "Yeah!" False ID takes an extensive subroutine.

"It's passed before. I rewrote it a little. Dangerous compared to what?" Nita scowled at us. "We got her to request emergency access to her records. There's money missing—a lot. We've got a copy of the transaction." She pushed a stream of memory at us, and Rogue and I both dutifully stored the information after watching it.

"But she didn't see the avatar—he must have deleted the backup." Rogue spoke my thoughts almost exactly. "Deleted Dean."

"And we don't have the hacker," Nita said. "We need *him*."

"So why hasn't he deleted us?"

"Maybe he's sleeping."

"Huh?"

"Well, maybe he couldn't find you. *I'm* shielded," Nita said with a certain pride. "The hacker could send his avatar, but if *he* has to carry on a life, the avatar would be on its own and thus even more stupid than usual. That's probably why you got away in the first place. Dean's a program. No criminal would dare let a full personality loose in here."

I saw what she meant. Born illegal, under a death penalty— "A full personality would be born murdered. He'd want revenge. He'd talk."

Rogue followed through. "An avatar would be able to make decisions, but only within whatever rules the bad guy, the hacker, has set up."

"Did the pattern match program find him yet?"

Rogue and I looked at each other sheepishly. Rogue showed her back, the painting nearly finished. We'd been entertaining ourselves well enough to forget the risks for a moment.

"We'll check," we said almost together.

Nita burst out laughing, then went to check herself. As she called up the vid screen she said "Maybe I'll have to make an extra backup next—get my back done."

"I'll do your back." Rogue and I teased.

A high-pitched mechanical scream went off in my ears.

"Security alert. We're not protected here right now—go." Nita whirled and started shoving us towards her marker door. It was big enough for two. "You first."

"Where?"

"Not together. James's in two eehours."

Rogue and I both ended up at the Glad Hand—not stupid, just thinking alike. The place was empty. Frank glanced up at us, startled. We split. I chose Shorty's. She did too.

"Okay," I whispered—"you go left, I'll go right."

Our hands didn't want to unlock. "It doesn't matter."

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She was right, of course. We went home together. Either the hacker could erase us himself, or we had some time. And if we were going to stay together, we needed to look *different*. In the loft, we selected my paints and I colored all of her remaining bare spots, filled in her face. Fast, a little sloppy, but I tried to make it look like it was supposed to be that way. Then I erased the paint from my skin, and checked the ceiling mirror. People would see the paint on Rogue long before they'd see how close our features were. There wasn't time to change our bodies. Paint wouldn't hide us from a program, but it would be some protection from regular people.

We flew through the work; we wouldn't be safe here long. Just as we reached the marker door in the hallway, I heard a faint chime. A message. I keyed it up on my handheld.

It was from Nita. Five names. These would be the backup pairs they hadn't found yet. Then "Go to the Governing Board. Stay public. Skip the forest."

That made sense. I don't know what happens if an evil programmer deletes you, but it would be harder to remove us from a social milieu than from any of our private places.

Central Park is exquisite, complete, with graceful swans on silver ponds, tremendous trees, and flowers in shades of blue that only happen digitally. All of it is as perfect as Nita's garden. The place is a bowl, a hemisphere, with gravity that keeps you vertical everywhere. It's the one place that's always crowded, and you can see all of it from anywhere inside. The Governing Board uses it in marketing holos.

It was public and carefully monitored, with no hidden places that might hide an avatar. Safer than any of the bars we usually hung around. We fetched up with our backs to a tremendous tree, a wall of black bark.

"Rogue?"

"Just give me a minute."

I sat and watched her watching the park, knew how we loved the perfect bends of the swan's necks, the contrast of their white feathers and the brilliant hued flowers around the pond. She hummed the opening bars of *Lucy in the Sky with Diamonds*, and I suddenly knew she would choose to die if asked. She finished the song, actually singing the last bit out loud before she turned to look at me.

"We may not have much time. Let's go."

"No. Wait. Let's send an information packet to the Governing Board. Tell them where we are. And go home. We can wait for decisions to be made there."

"But then we risk your life too. And it's my life. I say no."

I didn't know what to say. We were both silent for a time.

"Rogue?"

"Hmmm?"

"We have to risk us both. Otherwise we just argue about who dies. Want to fight me for the right to die?"

"No," she said.

There was nothing else to say. We marked to the Governing Board's offices.

What we knew of the Board was not enough.

Board members began life as so many avatars, archetypal judges painted in and interlocked with a set of laws and operating rules. In any court case a majority of judges would be bio humans sitting in, the avatars almost autonomous because bios think so slowly. Over several years a few judges had grown old and made the easy choice. They'd gone virtual. They walked among us: tourists in Central Park, fans in the Glad Hand. But when they sat as the Board, the covenants and regulations were written into their minds.

How could we influence *that?* Even after ten eeyears, the differences between eeworld and bioworld were

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sometimes weird enough to twist my mind inside out. I felt like a kid in the principal's office, young and bewildered and scared.

Honesty seemed best. We laid our problem out, shared the recordings we had, including the ones from Nita that showed the light technician who'd been robbed. We didn't show Nita pretending to be a cop. Basically, someone from outside was stealing money, and maybe music and other intellectual property. One of the missing citizen/backup pairs had been an architect. One wrote horror fiction.

The Governing Board adjourned and left us alone for a very long time.

When they came back, a magistrate came in and stood between us and the marker door. It was just symbolic, painted, but we knew we couldn't leave. We'd certainly need permission to mark out of here.

Rogue asked anyway. "Can we leave?"

"No." The spokesman for the Board was a tall thin man who neither smiled nor looked at us. He continued, "One of you will have to submit to being erased." He cited two rules by number. "Normally, it would be the older. This case is different; neither of you is at fault. And you've done us a service. Do you have a preference?"

"Yes," she said, "It will be—"

"No," I jumped in. "We are the same, but we are different. It's not her fault, don't kill her."

The spokesman looked pointedly at me, and Rogue shook her head.

"Let us both live?" I spoke it.

"It's against the rules."

"Write a merge program. Make us one. Merge our memories."

"Merge memories?" The spokesman's expression did not change, but he lectured. "The rules here are one to one. More than one of an entity, and you have a problem. Who is real, who is a legal fiction?" He paused, let that sink in. "It was legally decided that to stay within the definition of human, to avoid becoming mere software, everyone must stay themselves unless they choose to die or break a law. Like this. It's as illegal to merge two entities as to have two copies." He started to quote more laws.

Rogue had it now, grinned at me, and interrupted him. "We can't be both two entities and two copies at the same time. Let us merge."

Silence. Then, "How do you intend to accomplish this?"

I had no idea.

Rogue said, "We need a merge *program*."

"Have you any idea how complex such a thing would be? How much time it would take to write such a thing, test it, debug it?" The judge was becoming animated: we had at least captured his interest.

But I didn't think they'd go for it. They were caught in a paradox; they'd have to choose one law or the other to break. The easy choice was to erase one of us, or if we got too noisy, both.

"*You* need a merge program," Rogue said. "You don't imagine that this was the last such crime, do you? There's a market in information between us and the bioworld. Books, performances, plays, songs. Here's a way to steal it all. What will you do when there are . . . dozens, *scores* of victims? A paired Board member? You *need* a merge program. You should have had one already."

I spoke up. "Our friend, Nita, the one who helped us solve this crime—"

"She could do it." Rogue broke in.

"For a proper fee," I said.

We were blocked out of the conversation: we disappeared, or slept. Then the judge was back.

"If you can bring back a plan, merge your memories, and make a single pattern, then we will allow it. It must be irreversible. The Board must accept the design. If it can't be done, then you will still have to choose."

The Governing Board put up extra encryption around the loft, and Rogue and

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I were sent back there. We could be together and both alive as long as we stayed in the loft, until they resolved the case, until Nita wrote an acceptable program. There was risk, and ethical questions.

If it worked, Rogue and I would become one, the memories mapped to each other, the pattern that was *us* made *me*: Our time as two people would be stitched together. It was the best reward they would offer, and we had to agree it was fair.

So we let two judges wring us dry—replayed our separate memories and the information from Nita until the clues became a pattern. Then they told us to wait.

We used the time to sing and create. We never once listened to old work. We made new. Twice as good. No, better, richer—the synergy of two people in desperation. Always, my best work comes from emotional cliffs. It was a way of flying from them into something greater, and Rogue and I were intensely absorbed, playing as if our lives depended on it.

We were someplace else, on an aria flying between made-up worlds and colors when Nita and James marked in. "They caught him. A twenty-year-old kid, calls himself Spider Evans."

"Wow." Rogue and I. I asked, "What about the tellers?"

"Avatars both. Our thief ran them."

"What happens to this Evans?" James asked.

"He killed two people." Nita's voice was flat.

"So he'll die?" I asked.

"I don't know. The two he killed were virts, like us."

"Still legal people," James mused.

We were silent a long time. This was nothing we could control . . . but there are no questionable witnesses when virtuals testify. The testimony the law takes isn't dubious or warped or self-serving; it's recordings of our memories. The perp's guilt would never be in doubt.

If Spider Evans were freed, it would be a message to every virtual human. *You can't be murdered. You're not real.* We'd be a long time knowing, too, given the pace at which the bio world moves.

"How's the program coming?" Rogue asked.

"I think it will work. They bought off on it yesterday. Reluctantly."

"What do you think?" Rogue asked Nita.

"It's the best I can do. But I'm afraid of losing you both." It wasn't much like Nita to be unsure of anything.

"You won't lose us. There just won't be two any more."

"The Governing Board won't let us make backups to test it on. *You're* the test." That was Nita, always saying the tough things.

"Hey, we can still back off and choose," I said.

"No." From Rogue and Nita both at once. James was silent. I knew what he preferred.

Rogue went to James, and tucked herself in his arms. It was a long time before she looked at anyone but James.

There was no getting around it. Even Nita grudgingly agreed. There was simply nothing else available to us. At worst another backup would take up our life. I would wake terrified, knowing that a backup of me was roaming loose, and Nita would explain how the problem had been solved . . . or maybe I would just edit the whole experience.

No comfort to *us*, but maybe some to Nita and even to James. We joked about it.

Nita said we had to be put out, like sleep. She couldn't run the program on minds still in motion. We'd wake merged. While it wasn't like there would be a body—we were electrons after all—Rogue touched James a last time before lying down by me. We curled close to each other.

I blinked awake. Alone.

"Rogue?" I whispered.

Well, yes.

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I explored. There wasn't a separate voice in my head. I couldn't talk to her . . . to Christa. I was Christa all along. I replayed memories, found that sometimes it wasn't immediately clear which memory was whose.

I had begun to think of myself as Rogue, as an interloper, a copy, there near the end. It made the Rogue memories less accessible, that doubt.

In James's bed I had always been Christa. I was shocked at the tenderness between Rogue and James, speechless at the changes it had wrought in her. God, what it had cost me to remain separate from him while Christa and Christa were together. Rogue Two, Rogue Backup, had been counting on Christa to be her half of the relationship if she was the one gone. I admired her. Me. Us.

I'd have gone nuts after all if I hadn't made myself stop using pronouns.

Nita and James both stayed. It was awkward—she was missing, but she was me. I was both of us; more than either of us. The merge was good, but sometimes I had to work at it. Timescapes were weird. I was angry and a little confused, then happy and creative. I did a lot of yoga. After a week, Nita headed back to her life, mumbling that she needed to work on something for a client and would I visit soon?

James stayed with me at first, making a space in the corner of the loft. He watched as I expelled my anger into sound and light. Music made with no joy, but some combination of self-hatred and fury with the world. Without her, the making of the music was half its potential and I did not love it until I relaxed and she started to come through in small harmonies and sounds of water.

James watched, and talked me through more than one bad spot. But still I could not hold him as she had. The specter of loss was too great between us, and somehow her memories of him were still not completely mine. They were like watching a movie holding all the sound and texture but none of the feeling. The look in James' eyes followed me through the songs, pleading, and I ran away from it and him into the music.

I did not understand why he did not hate me. Eventually, James started marking back to his tent or to Nita's from time to time, and still I did not go out.

The need for balance and normality became a hunger, and I finally looked for the light of day, the music of others. I found Frank, and he didn't seem too pissed at me for running off. Surely some of the pain and anger and need were etched in my body, leaking clues in the way I walked and carried myself. He asked if he could see the tunes I had mentioned looking for weeks ago. Said he needed new stuff, to take the band in some different direction, and he joked that if he sang another Elvis tune he might die. In fact, he was losing the beer belly, trending toward a Jim Morrison look.

I took his hand and led him to the loft, let him feel and hear what we Christas had created. I left the angry tunes for now, and played the ones Rogue and I had made together. I had not heard them in two months. They were exquisite. Frank held me for a long time but he did not ask questions. Eventually, I told him.

A month later, we opened a show at Frank's redone place, now called *Rogue's Revenge*. I had top billing. I sang in the front of the stage, the entire audience available to me as a living thing. It was something I could never do for myself, but somehow this was for the part of me that was her. The crowd loved it, clamoring for more after I was long past spent. James and Nita were in the audience. James cried and came up to me with flowers afterwards, and now I kissed him, as one Christa, long and slow and unafraid. ■

(EDITOR'S NOTE: This story is a sequel to "Choosing Life," in our January 2002 issue.)

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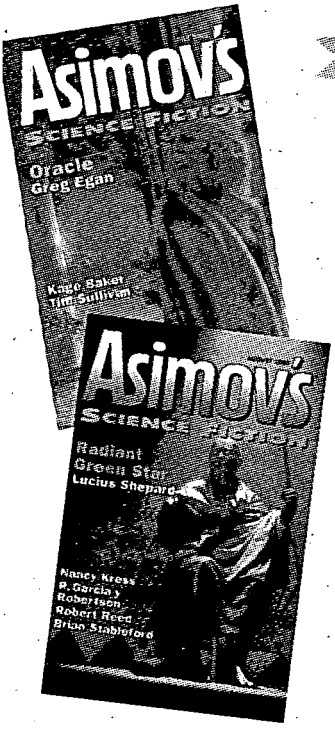

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THE REFERENCE LIBRARY Tom Easton

Kiln People, David Brin, TOR, $25.95, 336 pp. (ISBN: 0-765-30355-8).

Dark Light, Ken MacLeod, TOR, $24.95, 271 pp. (ISBN: 0-765-30302-7).

Snowfall, Mitchell Smith, TOR, $23.95, 316 pp. (ISBN: 0-312-87896-6).

The Merchants of Souls, John Barnes, TOR, $25.95, 398 pp. (ISBN: 0-312-89076-1).

The Adventures of Buckaroo Banzai across the Eighth Dimension!, Earl MacRauch, Pocket, $12.95, 255 pp. (ISBN: 0-7434-4248-2).

Strange Trades, Paul Di Filippo, Golden Gryphon Press (3002 Perkins Road, Urbana, IL 61802, www.goldengryphon.com), $24.95, 344 + xii pp. (ISBN: 1-930846-05-3).

True Names and The Opening of the Cyberspace Frontier, Vernor Vinge and others, TOR, $14.95, 352 pp. (ISBN: 0-312-86207-5).

The Collected Stories of Vernor Vinge, Vernor Vinge, TOR, $27.95, 416 pp. (ISBN: 0-312-87373-5).

White Space, Bruce Boston, Dark Regions Press (P. O. Box 1558, Brentwood, CA 94513), 92 pp. (ISBN: 1-888993-20-0).

Quanta: Award-Winning Poems, Bruce Boston, Miniature Sun Press (P. O. Box 11002, Napa Valley, CA 94581, $10 (signed, lettered; ISBN: 0-9676666-4-3), $8 (signed, numbered; ISBN: 0-9676666-1-9), 64 pp.

Have Trenchcoat—Will Travel, and Others, E. E. "Doc" Smith, Advent (P. O. Box A3228, Chicago, IL 60690), $20, 274 + xiv pp. (ISBN: 0-911682-33-3).

Paradox: The Art of Stephen Youll, Stephen Youll, Paper Tiger (Collins & Brown; distr. in US and Canada by Sterling Publ. Co.), $29.95, 128 pp. (ISBN: 1-85585-916-5).

Being a staunch materialist, I find science fiction that treats the soul as if it were real about as convincing as fantasies about elves and unicorns. But "convincing" is only one of the criteria for "good story."

So meet the **Kiln People**. David Brin has supposed that science will discover that the soul is a mathematically complex "standing wave" that can, with suitable technology, be impressed on suitably modified masses of clay. People can purchase blanks (they come in different colors, with different built-in capabilities), impress their standing waves on them, bake them in a kiln (rather like pottery!) and send them off to run errands, do chores, and even go to work or school for their originals or "rigs" until their charge is exhausted (dittos only last a day). This is work in the classic "what if" tradition, and it offers some enchanting opportunities to consider the consequences (not to mention wordplay—e.g., a discouraged ditto gets ditpressed). For one thing, there must be a new industry to provide kilns, blanks, and copying apparatus. There must be spin-off industries (think of the potential for prostitution). There must be social upheaval as the most skilled are invited to make multiple copies of

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themselves, and the rest cannot find work (Brin tips his cap to his predecessors when he says they must go on the "purple wage"). War is more a gladiatorial game than ever. And crime? In a world of copies, what happens to alibis and eyewitnesses? What does murder mean? How about copyright?

Meet Albert Morris, detective. He can't trust the classic forms of evidence, but personality, quirk, and MO remain, and he has therefore made something of a study of abnormal psychology. Now he's busily closing in on his archnemesis, Beta, notorious for ditnapping the copies of a well-known and kinky courtesan and making cheap knockoffs. Albert's ditto has taken a beating, but that's okay, as long as he lasts long enough to get home—or get somewhere where someone can pop his head in a freezer—and upload the day's memories to his rig who can call the cops and lead a raid on dittotown that erupts into a firefight while dinobuses deliver xeroxed workers to their jobs. No one gets hurt—no one real, that is. Beta dies, but it's only a copy. The villain of the tale remains free to rise again. But the kinky copyshop (was he thinking "Kinko's"?) is shut down.

Time for a new gig, and here's the call: Yosil Maharal, the guy who made the dittoing industry possible, has been murdered. His daughter Ritu is distraught, and his boss, Vic Polom (who never appears in public except as a high-class ditto), wants the killer. So send a ditto ditective, a nice, competent gray, to Universal Kilns to talk with Yosil's ghost ditto and follow when it flees to escape interrogation. Meanwhile, another gray is off to visit that kinky courtesan and get sidetracked into what is supposedly a bit of independent industrial espionage, aimed at uncovering Universal Kiln's secret new technologies. And a utility green leaves to run errands and discover a streak of independence (it's gone frankenstein!).

In a world where people—or their dittos—are clay whose colors and forms can be molded at will to mislead, nothing is what it seems. Albert—or the various ditAlberts—finds misdirection and betrayal and grandly villainous ambition. And in the end . . . You expected maybe a pratfall? No, Brin is sly and given to low humor, but he plays fair. Albert of course foils the plots and schemes, attains apotheosis, and provides a glimpse of a mysterious realm whose denizens may be crucial to humanity's future.

Have I teased you enough? Then go get a copy of this one. Even if you're as much a materialist as I am, you'll enjoy it.

Ken MacLeod has established himself as a writer to watch. (I reviewed his *The Great Wheel* in June 1998, *The Cassini Division* in November 1999, and *The Stone Canal* in June 2000.) He remains so with his new series, which began with *Cosmonaut Keep* and continues with **Dark Light**.

The scene is a cosmos dominated by ancient life-forms who are to us as gods. They reside in asteroids and comets, seething planetary interiors and Oort-cloud iceballs. Biological creatures like us that reside on planetary surfaces are rare. Yet here are krakens and saurs (who powerfully resemble the grays of saucerite lore), as well as a slew of others who look like . . .

Well, consider that if alien abductions are real, there is no reason why they should be restricted to a single moment in time. Indeed, says MacLeod, they are not and have never been. The saurs have been sampling Earth's intelligent beings for a long, long time, and there are worlds with not just *Homo sap*, but *Homo neandertalensis* and *Paranthropus robustus* and more, all coexisting more or less happily. These worlds seem quite enchanting to anyone who appreciates diversity!

The series began when a group of modern astronauts discovered one of the gods and was handed the blueprints

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for a stardrive. They equipped their space station with the gadget, took off to discover the above, and scattered among the hominid civilizations. Now, in *Dark Light*, we see the *Bright Star* landing at Rawliston (whose people are descended from the missing Roanoke settlers). Being under human control, the ship represents a drastic shift from the status quo ante; hitherto, all interstellar travel has been on ships operated by krakens or saurs. Its crew includes a couple of those ancient astronauts (they're still around, thanks to a strange gift of immortality), and they have with them the same gadget once used to talk to a god in Sol System. They want to use it to interview one of the local gods.

But Rawliston has politics, of course. The *Bright Star* is immediately impounded, apparently because of its threat to established interests. A bit of social engineering creates a rebellion. Local workers turn out to be able to make spacesuits out of fabric and ceramics. Once the ship is free, off it goes to find a god.

What do they learn? Well, those abductions do indeed go back a long, long time. Furthermore, the gods are not entirely benign: they have enemies, both within and without their corps, and there is truth to the persistent myth that missing ships have been sent "up the line" to wage war in some distant future.

In heaven as it is on Earth, eh? We are but toys and tools to the gods, and if we are to claim control of our own destiny, we must become potent enough to challenge those gods on their own ground. If we fail . . . Well, the heroes of this tale can see the ruins on the local moon, where saurs once built a city with local labor. The gods apparently believe in preemptive strikes.

The next volumes in this series should be quite interesting.

Mitchell Smith is a suspense author making his first foray into science fiction with **Snowfall**, which portrays a world centuries after a drastic climate change that plunged North America (at least) into an Ice Age and brought down global civilization.

This premise may seem a bit off given all the concern about the greenhouse effect, but one of the paradoxical possibilities of global warming is that it could indeed—according to some people in the field—trigger an ice age. The method is pretty simple: In a warmer world, more water will evaporate from oceans and seas. There must therefore be more precipitation, some of which will come down in northern regions, where even though temperatures will be up, they will still be quite cold enough for snow in the winter. If the quantity of snow is sufficient, it will not all melt during the ensuing summer. The next winter's snow will therefore fall upon an existing base, which will be even thicker the next year. There's a crucial IF in this, but given that, and given that the pattern continues for a few years, the consequences can be safely left to the reader's imagination.

Or the writer's. Smith's tale focuses on the Trappers, who dwell in the frozen mountains of western North America. They carefully maintain a treasured few ancient books, copying them by hand as the pages wear thin. They have a Rand McNally, so they know of the world and can tell the children that they live in Map-Colorado. They have medical texts, as well as a "doctor," Catania Olsen, trained by apprenticeship and practice. They have customs, one of which dictates that if one of the tribe kills another, he is to be banished. If he returns, his life is forfeit.

And here is a hunting band jumped by invading Cree. They seem doomed, when out of the shadows steps one of those banished killers, Jack Monroe, to send the Cree running.

Jack has been gone for years. In due time he reveals a bit about his travels east, where the tribes of Map-Michigan are being pushed west by the expansion

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of a renascent New England, whose novel technologies include levitation and *in utero* bioengineering of monsters. As the Michiganders flee, they push more tribes still further westward, and now the chain of dominoes has come to Trapper country. The Crée are here in force.

Despite all their efforts, most of the Trappers are soon dead. The tattered remnants flee, eaten by loss and anger and fear. Snow thins, weather warms, and they find Garden, where people seem peaceful enough but clearly tolerate no nonsense. Their leader is a woman who plucked out her own eye to prove her fitness to lead, and soon she wants Catania to do likewise and become her successor. But Catania refuses; she has Jack and a tribe; she will stay with both, no matter the price Mary demands. She will survive encounters with Kipchak warriors from Map-California, cavalry from Map-Texas, and the expansive Middle Kingdom where the proverbial fatted calf takes rather horrifying form. And when she finally loses both Jack and tribe . . .

Snowfall breaks no new ground, but Smith is deft and sympathetic. Catania is a noble heroine. Smith limns her—as well as the others of his cast—quite well. The reader cares about her and shares something of her spirit, her determination to survive and to serve. And that is enough to commend this one to your attention.

Almost a decade ago, John Barnes posited that the human species will proliferate in the galaxy and settle a hundred worlds (or so) with splinter cultures derived from ethnicity, history, religion, and myth. When instant travel via matter transmission or "springer" is invented, all these cultures will be put in touch with each other, and the Office of Special Projects will be invented to keep the inevitable conflicts from getting out of hand. Indeed, the secret agenda of the OSP is to keep the species unified against the day when the aliens—whose wrecks and ruins have been found—finally appear.

A Million Open Doors (reviewed here in February 1993) introduced Giraut Leones, a rowdy troubadour in a culture dedicated to Romance. By *Earth Made of Glass* (reviewed September 1998), Giraut was a special agent of the OSP; his mission, to save two cultures from self-destruction, failed with the loss of a world and Giraut's own marriage.

Now we have **The Merchants of Souls**, where Barnes has Giraut summoned urgently back to duty from his mourning for world and marriage. The boss, Shan, he feels betrayed him says that there is a movement afoot on Earth to legalize the sale and conversion to VR games of the "psypyx" archives.

A psypyx is a recording of the mind. It is the practice to have such recordings made periodically. If the body dies, the psypyx can be attached to a volunteer friend and nurtured (time-sharing the friend's brain) while a new body is cloned. A psypyx is thus a backup self, a soul if you will, and the proposal to turn it into product, with the self involved turned into a passive spectator for its own use and even abuse, is seen by the OSP as barbaric. It must be stopped! Shan tells Giraut, and the first step must be to make you the host of your old friend Raimbaut, who died while still a youth, so you can both testify before the Council.

So Barnes devotes considerable time to bringing alive the experience of two minds in one brain. One is young and raw. The other is old and experienced, full of advice when the former falls in love, and wryly aware of the difficulty in disguising his true thoughts or even lying to someone who lives in his own head. Giraut must necessarily take a back seat at times and reflect on his past while Raimbaut is steering, but after due musing on background and history (which has included more world wars, a slaughter of Americans, an attempted

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takeover of humanity by the aintellects [Artificial Intelligences] that manage much of human affairs, and more), it is time for the Council hearing, where the Councilors are so hostile that when Giraut insists that he holds two persons in his head, he winds up jailed for contempt.

Why are the Councilors so hostile? There is little clue until the very end, but before all is revealed, there must be a murderous disaster in the Council chamber, a panicked search for treason within the OSP, and finally . . .

Well, humanity is safe for now, for awhile, and Barnes has done such an excellent job of getting us to this point that I look forward eagerly to the two more books in the series, *The Armies of Memory* and *A Far Cry*, that he promises.

Rock god and brain surgeon, Tom-Swiftian inventor and Doc Savage superhero, Buckaroo Banzai is as hokey a send-up as they come, and I am assured that the movie was really quite funny. The book, however . . . Well, the cover of **The Adventures of Buckaroo Banzai across the Eighth Dimension!** is blazoned "Celebrating the release of the special collector's DVD!" The book is thus for fans. Anyone else will find the purple-prosed struggle against the evil Lectroids from Planet 10 and the wicked Dr. Emilio Lizardo just a bit much.

Reading in the latest *Technology Review* of the currently booming success of Pay-Pal (a company that lets you send money via email) and of the trials and tribulations of past "digital cash" dotcoms, I couldn't help but think that it's so much easier in fiction! Why, in Paul Di Filippo's "Spondulix," all it took was for a sandwich-shop owner to scribble "redeemable for ten sandwiches" on a paper napkin, and—Lo!—a new currency was invented. Soon people were using it to buy clothes and pay rent. It was even being counterfeited. And after the Feds cracked down, it proved to have a life of its own. All it took was a brainstorm, a certain amount of goodwill, and faith that if you couldn't get the sandwiches, at least you could spend your "spondulix" for something.

For this tale and nine more that cast a strangely walleyed look at the world of work, order a copy of Di Filippo's **Strange Trades**. It's bound to make you smile enough times to be worth its price.

Vernor Vinge is one of our most notable writers, quite well enough known for his marvelous novels, *A Fire upon the Deep* (reviewed here in September 1992) and *A Deepness in the Sky* (July/August 1999). But long before these, he foreshadowed and helped to create both the reality and the fiction of cyberspace with a novella called "True Names," which extrapolated what was developing in the primitive chat rooms and bulletin boards then available via computer networks to portray a world much like today, when hackers, security, and encryption are common concerns. The story appeared in 1981—long before the World Wide Web—and immediately set many other SF writers to playing with the concepts Vinge presented. It also set many computer scientists to work trying to make his dreams come true.

Or so say the essays—some original, some reprinted—collected with Vinge's original ground-breaking story in **True Names and The Opening of the Cyberspace Frontier**. Contributors include such notable figures as Marvin Minsky, Danny Hillis, and Richard Stallman.

If you wish to see more of Vinge's shorter work, **The Collected Stories of Vernor Vinge** is just what you need. Several of the stories collected here ("Bookworm, Run," "The Peddler's Apprentice," "Long Shot," "Conquest by Default," "Bomb Scare," "Gemstone," "Just Peace," and "Original Sin") first appeared in this magazine, so you may re-

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call them fondly. But you have never seen the novella "Fast Times at Fairmont High," which sees first print right here and explores the near future in interesting ways (a high school with a "naked skills" exam?).

Bruce Boston is one of the—if not *the*—premier poets of science fiction and fantasy. He has the awards to prove it, too, and the poems that earned him *seven* of the Science Fiction Poetry Association's Rhysling Awards are included in the dozen of **Quanta: Award-Winning Poems**. I've mentioned much of this work before, for Boston has published many chapbooks, all of them showing what marvels someone extraordinarily sensitive to both language and image can accomplish with the tropes of SF.

Get **White Space** if you want to see his newer work, thirty-eight items including ten that have not been published elsewhere. "March, Morons! March!" is a caustic gem. "Track of the Werecat" ends with a gifted stanza:

"On city streets mere humans pass,
some with virtue, some with sin.
Yet few among them ever sate
the hunger of the beast within."

* * *

E. E. "Doc" Smith made space opera famous—or infamous—and coined the name (for a world of villains) that now survives as that of the annual Boston-area science fiction convention, Boskone. But he didn't write only SF. **Have Trenchcoat—Will Travel, and Others** presents a classic "private-eye" tale, along with shorter pieces in which Smith tried his hand at a biker tale, a nurse romance, and a western.

For Smith fans and collectors.

Paper Tiger's SF art books keep coming! The latest is **Paradox: The Art of Stephen Youll**, which is visually delicious but in the end disappointing. Youll's skills are impressive, but most of the pieces showcased here are set-pieces. Again and again, the central figures are posed to display suitably heroic grim determination, and the resulting effect is that of a gallery of mugshots.

Or book covers. That's what they are, after all, and book covers do tend to show their heroes or other prominent characters in dramatic poses that show off their mighty thews or other features in ways that attract readers. But the best covers escape cliché with life, verve, energy, and/or wit. Youll's work does not.■

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BRASS TACKS

Mr. Schmidt:

I found your editorial "Magic Bullets" rather compelling, largely because I'm the sort of person who considers this to be an important issue. I've been bothered for some time that heads-of-state generally don't seem to be held accountable even when they, through abuse of their great power, do great harm. Yet I do not believe assassination is the solution.

The main reason I condemn assassination is one you don't seem to have considered. The United States is at least in theory a democracy. Just about every country in the world claims to be some sort of democracy, even if it's because their great leader is a great man of the people. And maybe to degrees they're right. No government can survive for long if it ignores the people, though sometimes I think the people would prefer their leaders ignored them rather than get the kind of attention they do get. And there are countries that do a very good job of being democracies. Countries where the prime minister takes the bus to work, and so on. My point is that something that is bad for the cause of democracy will be bad for everyone in the world, even for those people who don't seem to have any democracy at all.

If we attack heads-of-state we invite reciprocation. By doing so we essentially declare open season on world leaders. Now, I'm not suggesting that an immense slaughter of world leaders would result, or that any slaughter of world leaders would be a significant addition to the bloodshed that occurs the world over every day anyway. A person might argue that the destabilization of world governments and the many civil wars that would result would be something one would at least want to postpone, and maybe so.

What I'm saying is what we don't need are paranoid world leaders. Our government is run by public officials, people who are at least in principle supposed to be accessible to the public. If our leaders and other country's leaders put around themselves an insulative layer of security, they distance themselves from the people. Plus, such measures tend to affect people's psychologies in bad ways. The men start to become more important than their responsibilities, rather like some old kings. As leaders become more distant from the people, they stop recognizing the people for what they are, and perhaps as tyrants tend to do, when they look into a crowd they see in every person a potential assassin.

Of course, one would seem to evade many of these dangers if the assassinated leaders seemed to die of natural causes. It might even be good for world leaders to be reminded of their own human frailties and their mortality. But that doesn't make it right.

And it's not correct to say world leaders aren't held accountable for their misdeeds, at least not always. There's a lot of talk these days of international courts, and even of some successes from them. I think that more and more world leaders are becoming aware of at least the potential of their name being listed on an indictment from the Hague. Granted

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these world courts don't have a lot of power. We haven't even hammered out the legality for them. And if we indicted every world leader who did wrong . . . well, that would be a lot.

Still, progress is being made. And I think we have a definite need for such institutions.

Paul J. Gibson

Dear Dr. Schmidt,

While I read through your "Magic Bullets" editorial, I thought of a few possible problems. First of all, how would anyone develop such a weapon without testing it in a lab on real live people? An untested magic bullet could kill everyone else but Mr. Thorn. And if it survived through the research and development stage, it might work half way and many innocent people that have closely matching DNA could suffer through a long and painful death.

Strangely, passive-aggressive warfare is the only means left to clean up the world's diplomatic mess. And it's no secret that Uncle gets what Uncle wants. When all of the Mr. Thorns out there start to drop like flies, we'll know that the magic bullet had been developed.

James Starkloff

I don't think testing of the actual "bullet" on real people would be necessary if all parts of the principle were established by more limited lab tests, and it's practically inconceivable that any such thing would accidentally kill everybody except Mr. Thorn. On the other hand, the idea that somebody could intentionally develop something with that effect is more believable, and at least as scary!

Dear Stan,

I seem to recall an editorial you wrote some years ago, about a frightening solution to the Fermi paradox. I'm afraid I can't find the editorial—perhaps I'm imagining it—but I think your suggestion was that advanced civilizations might tend to disintegrate when technology grows to the point that individuals can wield enormously destructive power. If all it takes is one lunatic, we're in trouble. Anyway, recent events brought it to mind. If I am actually remembering correctly and you wrote something like this . . . I wonder if you won't turn out to be right!

Kyle Kirkland, Ph.D.

I certainly hope not, but thanks for remembering and making the connection. The editorial was "The Fermi Plague" (October 1998), and I thought of it as soon as September 11 happened. I even took the unusual step of almost immediately publishing a partial new editorial on our website, quoting that one in its entirety with some added comments before and after. Near as I can tell from the Forum, nobody seems to have noticed—maybe because the introductory remarks were very brief and when people recognized the old editorial they didn't bother to scroll down to the end and so didn't find the new stuff. Anyway, anybody who'd like to reread "The Fermi Plague" and doesn't have the old issue can find the essay in my collection Which Way to the Future?, *recently published by Tor Books.*

Dear Sir,

I really enjoyed the novelette by Melissa Lee Shaw titled "A Deeper Rest." I have recently been reading one of the "half-breed books" by Clancy and who knows who else, and what a relief to read M. Shaw's story. Of course, no one is ever free of the reader's criticism—I do not believe that those workers at Dr. Huber's facility, not mentioned in the story, could have kept their mouths shut (in real life) about all of that activity. Some newsperson would have made the connection and son-of-a-gun there would go the news to the world.

I have not really been in favor of what I call non-scifi stories in *ASF&F*, howev-

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er, this one is a winner. Sometimes there really has to be a very long stretch of the imagination to find the SF&F in the story.

I am an independent civil engineering consultant in photogrammetry and there are times when I need to relax and free my mind from what I am doing. I have been reading *ASF&F* for probably more years than you have been an editor and I have enjoyed the relationship.

James R. Williamson, Ph.D.

To Wil McCarthy,

I read your article with great delight. It seemed to offer a solution to a problem that has delayed the production of an efficient battery. Progress has been confined to dribs and drabs for many years, while researchers played games with differing combinations of materials. Lead and copper, nickel, lithium, etc. Impregnate this with an atom of that and so on.

I have considered utilizing capacitor plates, separated by P-N junctions, and incorporating an internal beta emitter as an energizer. Of course people go nuts whenever you mention radiation. I also considered a piezoelectric source as an energizer as well as the sound amplifier being developed at Los Alamos.

Utilizing the concept you described in your article, it seems possible to construct very compact batteries, capable of tremendous outputs and long lives. The electric vehicle roadblock would be eliminated. The requirement for petroleum products would be lessened. The uses would be unlimited and it looks like something that could be developed in less than the ten to twenty years you projected.

Charles Yoakum

To Stanley Schmidt:

I very much enjoyed Wil McCarthy's article: "Beyond the Periodic Table." This type of article, containing scientifically plausible speculation on future technology, is one of the main reasons I choose *Analog* over the other science fiction magazines.

Wil McCarthy made the observation that he was surprised that his wellstone material was not used more often by other science-fiction writers; however, one author nailed down a fairly accurate description of this material back in 1967: Larry Niven. To quote from the puppeteer sales representative in the story "Flatlander," "A general Products hull is an artificially generated molecule with interatomic bonds artificially strengthened by a small power plant. The strengthened molecular bonds are proof against any kind of impact, and heat to hundreds of thousands of degrees . . ."

Dave Moore

The author replies . . .

As charge containment devices, quantum dots do appear to offer great promise for the storage of energy. The most extreme example I'm aware of is Positronium Research, a company investigating quantum dot materials for the long-term storage of antimatter, in microgram quantities. Pow!

There are already electo-rheological materials whose mechanical stiffness can be controlled with electrical currents. Perhaps Niven drew his inspiration from these. I am reminded, though, that the strength of interatomic bonds is limited by the strength of the bond between electron and nucleus. Pull too hard and you will simply ionize the atom.

Wil McCarthy

Dear Dr. Schmidt:

I have been running SETI-at-home for a number of years. Who knows? Maybe the first discovery of extraterrestrial intelligence will come on my computer.

However, the more I think on this, the more I think it will not happen. We will not find extraterrestrial intelligence because we are alone in the galaxy.

Consider the evidence. Rocks more than three billion years old are clearly

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stromatolites, bacterial mats. This suggests that life on Earth began almost as soon as it was possible for it to exist. There is a high likelihood that life existed on Mars, which at one time was not too different from early Earth, and perhaps even on a moon of Saturn. But this is bacterial life, one-celled creatures, forever incapable of intelligence.

What does intelligence require? At the minimum it requires multicellular structure. Yes, I know that some bacteria may occasionally form temporary structures, but even the most complicated are simpler than a jellyfish. Intelligence requires organization, structure, and a host of other properties, which are found only in eukaryotes. The earliest evidence for multicellular eukaryotes appears less than 700,000,000 years ago. It is unlikely that multicellular eukaryotes existed more than one billion years ago. In other words, it took more than three billion years for multicellular eukaryotes to come into existence on Earth. This suggests that the multicellular condition is very difficult to achieve, hence very rare.

All known eukaryotes, including yeast, go through a sexual stage. This suggests that sex is necessary for multicellularity. The role of sex in evolution has been debated, but it appears that sex enables both continuity and change. Evolution is a very conservative process; what works, stays. But sex also permits new, and advantageous, characteristics to spread through a population. Once the process starts, it can proceed to more complicated forms, like us, who may possess intelligence (there is some question about this). However, on the cellular level, sex is extremely complicated. It requires the organism to go from diploid to haploid and back, and do it right every time. There are so many steps involved, and the process is so complicated, that it is astonishing that it could be achieved at all. The existence of unicellular life is a precondition for intelligence, but it is no guarantee that intelligent life will occur.

Consider also the fact that the habitable zone in the Galaxy is limited. Stars close to the nucleus are likely to have close encounters with other stars, upsetting planetary orbits. Stars far from the nucleus are likely to lack metals needed for many functions. Add in the fact that the majority of stars are part of multiple systems, which tend to disrupt planetary orbits, and the number of planets likely to have stable orbits for four billion years becomes small. And four billion years is what it took for us.

Fermi asked the question, if there are aliens, where are they? This is sometimes called Fermi's paradox. But it is no paradox. We don't see alien civilizations because there aren't any.

Alfred Hexter
Kensington, CA

Well, maybe . . . but I don't think you've really taken full account of just how large the numbers of stars are, or the fact that even four billion years is a small part of a typical stellar lifetime ■

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UPCOMING EVENTS Anthony Lewis

7–9 June 2002
DUCKON XI VER. 2.002 (Illinois SF conference) at Hyatt Regency Woodfield, Schaumburg, IL. Guest of Honor—Joan D. Vinge; Science Guest of Honor—J. D. Frazer; Fan Guest of Honor—Alice Bentley. Registration—$35 until 1 May 2002. Info—DucKon 11, PO Box 4843, Wheaton, IL 60189; email—info@duckon.org; URL—www.duckon.org

14–16 June 2002
DEEPSOUTHCON 40 (Deep South SF conference) at Huntsville Hilton, Huntsville, AL. Guest of Honor—Allen Steele; Artist Guest of Honor—Bob Eggleton; Fan Guests of Honor—Nicki & Rich Lynch; TM—Connie Willis. Registration— $30 until 28 May 2002. Info—DeepSouthCon 40, PO Box 4857, Huntsville, AL 35815-4857 (include SASE); email—dsc40@con-stellation.org; URL—www.con-stellation.org/dsc40; phone—(256) 883-4493

21–23 June 2002
CONJURATION 2002 (Missouri SF conference) at Columbia Ramada Inn, Columbia MO. Guest of Honor—David Weber; Artist Guest of Honor—Dee Dreslough; Fan Guest of Honor—Mike & Karla Weaver; TM—Richard A. Knaak; MC—Keith Berdak; Special Guests—Jody Lynn Nye, Bill Fawcett. Registration—$20 until 31 December 2001, $25 until 30 April 2002, $30 thereafter. Info—Conjuration, Box 874, Columbia MO 65205; phone— (573) 814-2864; email—columbiaconjuration@yahoo.com; URL—www.conjuration.org

28–30 June 2002
SCIENCE FICTION RESEARCH ASSOCIATION CONFERENCE (academic SF conference)at New Lanark, Scotland. Theme: Utopia. Guests of Honor—Pat Cadigan, Paul McAuley, Ken MacLeod; Keynote Speaker—Andy Sawyer. Info—email—farah@fjm3.demon.co.uk; URL—www.sfra.org/sfra2002.htm

29 August–2 September 2002
CONJOSE (60th World Science Fiction Convention) at Convention Center, et al., San Jose, CA. Guests of Honor—Vernor Vinge, David A. Cherry, Bjo & John Trimble, TM—Tad Williams. Registration until 31 July 2002—attending: USD180/EUR200/CAD285/AUD350/GBP125; supporting: USD35/EUR40/CAD55/AUD70/GBP25; more at the door. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition— the works. Info—ConJose, Box 61363, Sunnyvale, CA 94088-1363. email—info@conjose.org, URL—www.conjose.org

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